June 1977

Smithsonian

Rootin'-tootin' horseman tromps
a lion—from Thracian treasures
to be seen in North America (p. 42)

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Smithsonian

Volume 8, Number 3

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Case Histories . . . Part III

On how to LIVE 90 to 100 HEALTHY years

(The syndrome of longevity . . . its 7 great "constants")

"There is no short-cut to longevity. To win it is the work of a lifetime . . ."

—Sir James Crichton-Browne (1840-1938)
in his *"The Prevention of Senility"*

The errors of our younger years are drafts upon our older years, payable (with interest) some 30 years from date.

The so-called "diseases of old age" are essentially the diseases of 50 to 70 . . . *"the dangerous years!"*

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To try to find out, some careful studies have now been made of these *extraordinarily* long-lived individuals.

What do these show? Is it what you might expect . . . just a matter of sheer chance . . . *amazing luck?*

Luck plays a part, of course. (This world is a dangerous place. It always has been and, probably, it always will be!) But these studies show that other factors (not at all dependent on chance) seem *dependably* present . . . "constants." As you study the *case histories* of these extraordinarily long-lived individuals, 7 of these great *"constants"* almost invariably turn up! They form what is now becoming known as the *syndrome of longevity.*

As an executive, your safest guide (as to what you should do, or not do, to live a long, long time *in good health*) is to study, and try to apply to your own life, these 7 great "constants" so evident in the lives of other executives who have outlived their contemporaries *by a generation.*

Nearly four years ago in *Executive Health* (Vol. III, Nos. 5 and 6) we gave you some detailed *case histories* of distinguished men whose lives sharply emphasized the

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The view from the castle

Our differences and our common purpose
are parts of the great American mosaic
the world can admire—so is our humanity

One of the most responsive chords which President Carter has struck across the nation and internationally is the reaction to his personal sense of humanity.

"I look on our country as more of a beautiful mosaic, with different kinds of people involved in freedom, individuality, pride, cooperation, understanding, searching for answers to difficult questions in their own way, each contributing, hopefully, the strongest single characteristic of their background and heritage and special sensitivity to a common purpose," he said in mid-February at the Department of Health, Education and Welfare.

To us at the Smithsonian these remarks symbolize the essence of our Folklife Festival and our historical collections. In our festivals we have demonstrated the evolutionary product of customs and cultures derived from all the continents. In our historical collections we show the end products of adaptations to living, inventions as "answers to difficult questions" for modes of life from poles to equator. We celebrate folkways and the persistence of traditions among all minorities.

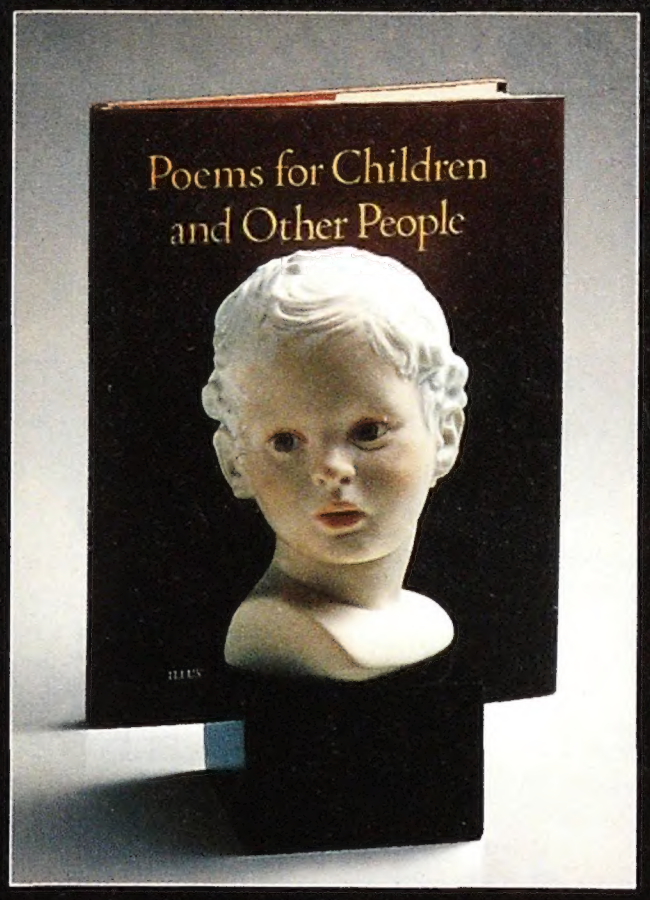
The point of our festivals and our displays of Man's diversity strikes home to the people who come to our museums and reach out for reassurance from the sight of these things. It is to them a reaffirmation of identity. We fear the loss of it in the sense of anomie that comes with being a cipher, a numeral, a set of digits. We fear big government, big business, megastates that might rule the world. Coupled with the fear of homogenization is the fear of the loss of our own souls. I feel that our new President recognizes this fear, and views it as part of his task to restore the confidence that comes with a renewed sense of faith in our institutions, a humbling sense of the duty of our government to work for all our citizens and a conviction that identity will be preserved.

This message is of the first importance. Those of us who follow peoples across the world—families, clans, tribes, especially in the less developed areas of our planet—are desperately aware of the tensions created by the suppression of roots, of traditions that nurture the sense of identity. Much of the persistent unrest in countries today stems from striving for identity.

In this age of technical development we worry about "peace, food . . . no more people than the earth can take," as Lord Snow describes our real problems. We also worry about schools training children to be literate enough to function with the skills needed for day-to-day industrialized life, as well as teaching professionals enough in a technical age to maintain a dialogue about each other's specialty. And so there is a new element that must be added to the governmental technician's craft—humanity.

In his book *Why Not the Best?*, the President speaks of the leadership of which this government is capable in the world community. Peoples everywhere, he writes, know of that capability. We have honesty and morality to which all can aspire. One way to demonstrate our essential humanity, a way that may elude the technicians busy at the helm of our vast bureaus of government, is a reaffirmation of the differences among us, the persistence of our traditions at the ground roots of life, a countercurrent for survival.

S. Dillon Ripley



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The Rabbit also has (shockingly!) more trunk space than 34 other cars, including Cadillac Seville, Thunderbird, Camaro, Monza, Nova, Comet, Starfire, Firebird, Skylark and Ventura.

These are official U.S. Government statistics, by the way, published in the official Environmental Protection Agency 1977 Gas Mileage Guide.

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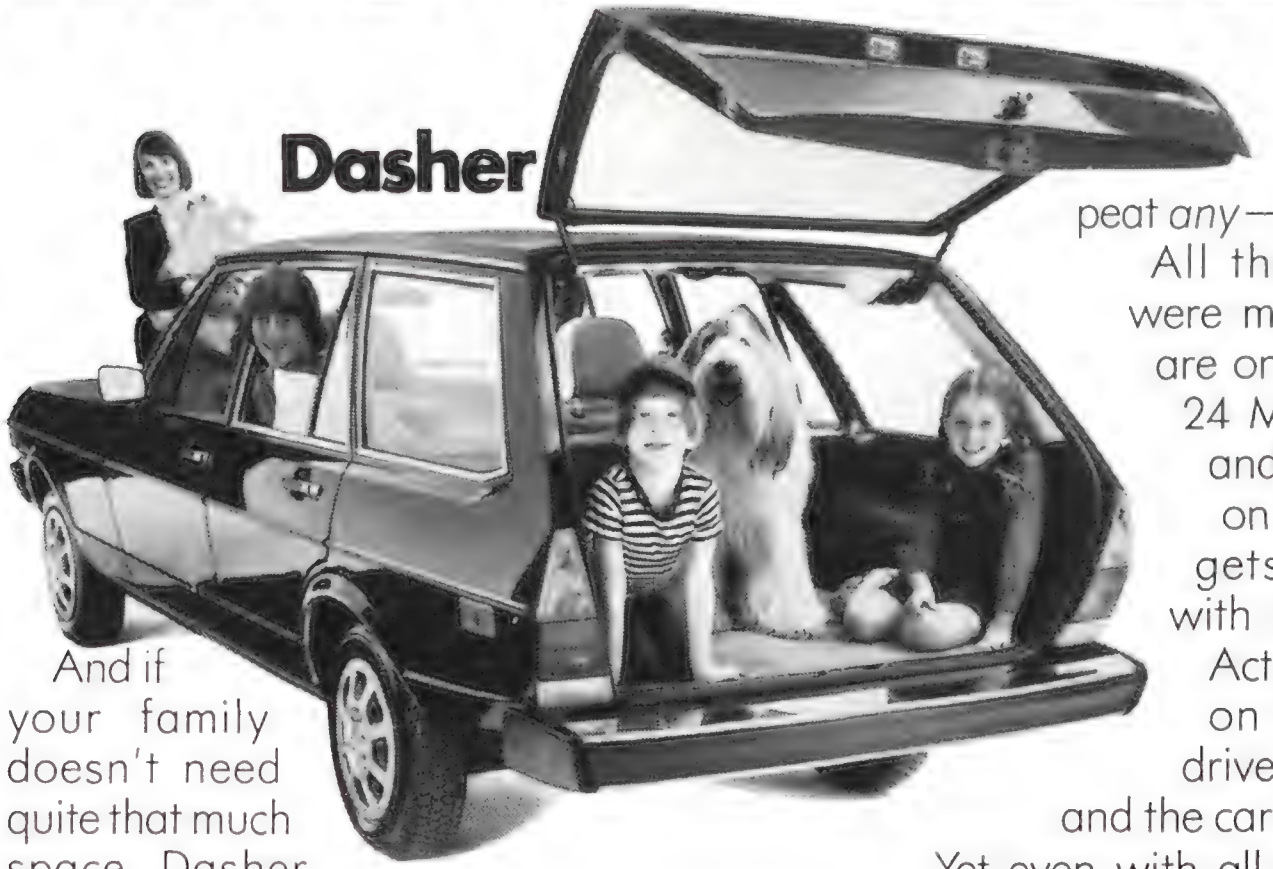
Rabbit

energy crisis into a small car.



And if your family doesn't need quite that much space, Dasher also comes in a beautifully appointed 2-door Hatchback and 4-door Sedan. Yet both Dashers have way more passenger room *and* trunk room than *any* Japanese car in their class and more than most American cars in their class.

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Around the Mall and beyond

Jazz resounded from a simple stage outside the Museum of History and Technology—nice springlike music with enough blues notes in the theme to recall the pain of love and enough recklessly unrestrained solos to evoke the impudence of youth. People were sitting on the warm ground, listening and clapping. But this was no formal concert where everyone shushes and concentrates. It was just a little something on the Mall, along with squealing children playing tag, barefooted office workers scaling Frisbees, lovers holding hands and leaning against each other, old people with their faces turned toward the sun.

I stopped and listened for a while, realizing that the Smithsonian, whose Division of Performing Arts arranged this "Spring Celebration," is uncovering, within the busy, achievement-oriented American character a sense of fun.

Approaching me, a harried executive slowed his purposeful stride, loosened his tie and quite noticeably lost the hard lines around his mouth. Nearby, a hard-hatted construction worker, shoulders bulging under a stained striped shirt, belly overhanging a broad, heavily buckled belt, leaned against a tree and let his cigar stub die in his mouth as he listened. Then, ponderously, he applauded the long-haired college kids who were giving him pleasure. Magic, indeed.

As you read this, the Indianapolis 500 is just about to roar off to a start, or has gasped to a halt for another year—depending on how good the mail is in your part of the country. It's conceivable that you don't give a sniff for the Indianapolis 500—back in New Hampshire, my father's

friend Slocum eschewed any car that he couldn't fix by kicking it "on the front nigh wheel"—but you must admit that the "Indy" is a rite of spring.

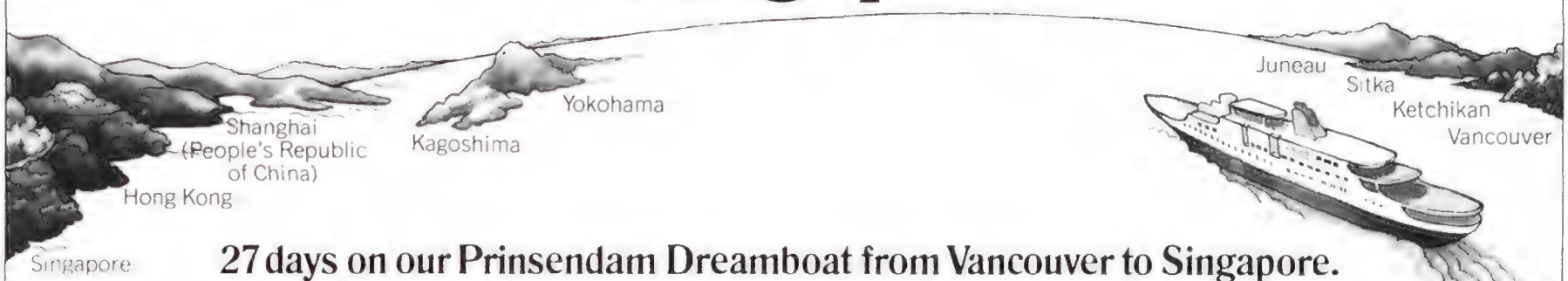
Thus on that sap-stirring morning I dragged myself away from the fun on the Mall to see in the museum two racing cars, veterans of the 500, that have joined the collection in the Hall of Transportation. One is the controversial STP-Turbocar which went so blisteringly fast around the "brickyard" (we Indianapolis buffs have a slang all our own) exactly ten years ago that other owners, drivers and good ol' boys of car racing howled that it ought to be banned because its Pratt & Whitney turbine, using kerosene, just wasn't *fair*.

With only three laps to go for a rousing victory, this "Silent Screamer" broke a bearing. Even so, Parnelli Jones fetched up in sixth place, presumably coasting.

The other car *did* win the Indy, two years later. Mario Andretti, a colorful and likeable driver with a noteworthy affinity for public relations, hauled it out of storage and hopped into it at the last minute when his assigned vehicle conked out, then went screaming around the

Springtime celebrants bask and frolic on the Mall during concerts with jazz, bluegrass, swing, singing quartets, a drill team of mounted policemen.

We'd like to get you on a slow boat to Singapore.



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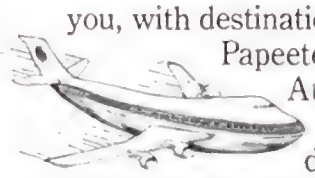

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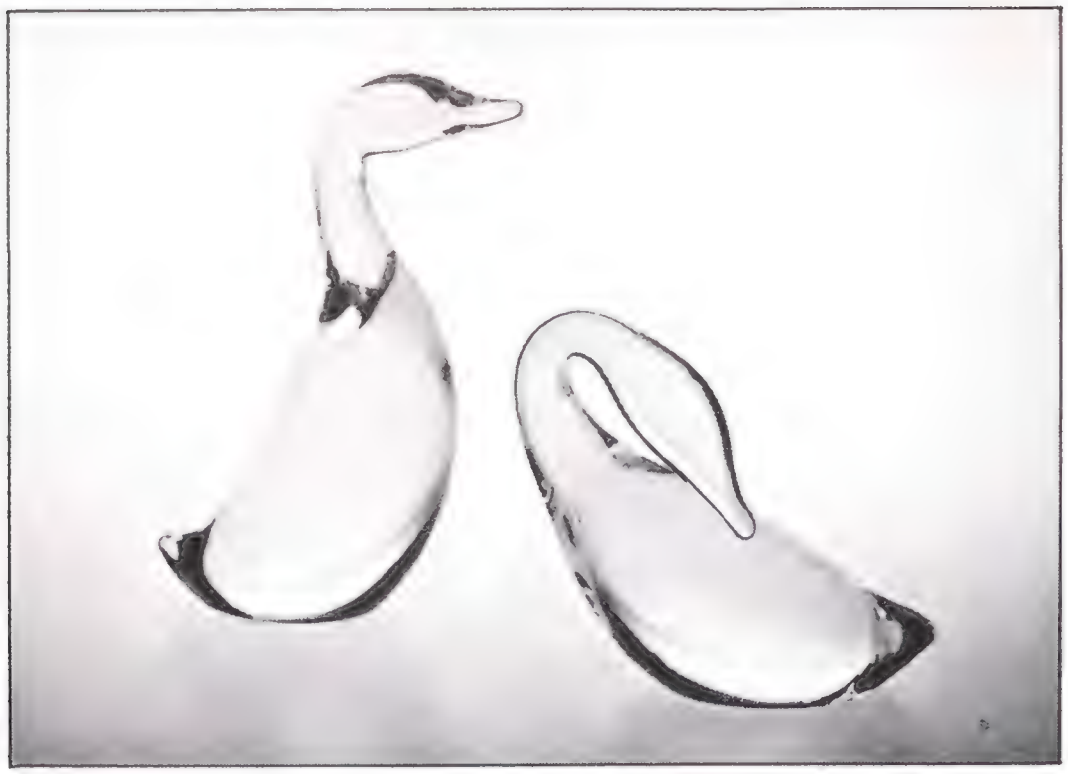

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Turbocar "Silent Screamer" (right) and Indy-winning "Cinderella Car."

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bricks to glorious triumph. Sportswriters, ever nimble with the apt sobriquet, called the winner "Cinderella Car." And here it is, right beside the "Silent Screamer," gleaming and scarlet and beautifully functional. Both cars look as though they had never been driven an inch, much less 500 miles at hair-raising speed. "Slick as wet soap," Slocum would have said, restraining, I hope, his impulse to lay a country boot on the front nigh.

There are several Smithsonian people who can claim credit for the special attention the Institution gives to our sense of fun. One of them is Ben Lawless, assistant director of exhibitions at the Museum of History and Technology. That title, he says, allows him to dip, happily, into a number of fields of interest. He has a finger in the performing arts which, like that jazz band, enliven his museum. He has a thumb in art, a toe in engineering and his whole head into film-making. He was, in fact, the writer of the film *Celebrating a Century* which we staged at the "1876" exhibit

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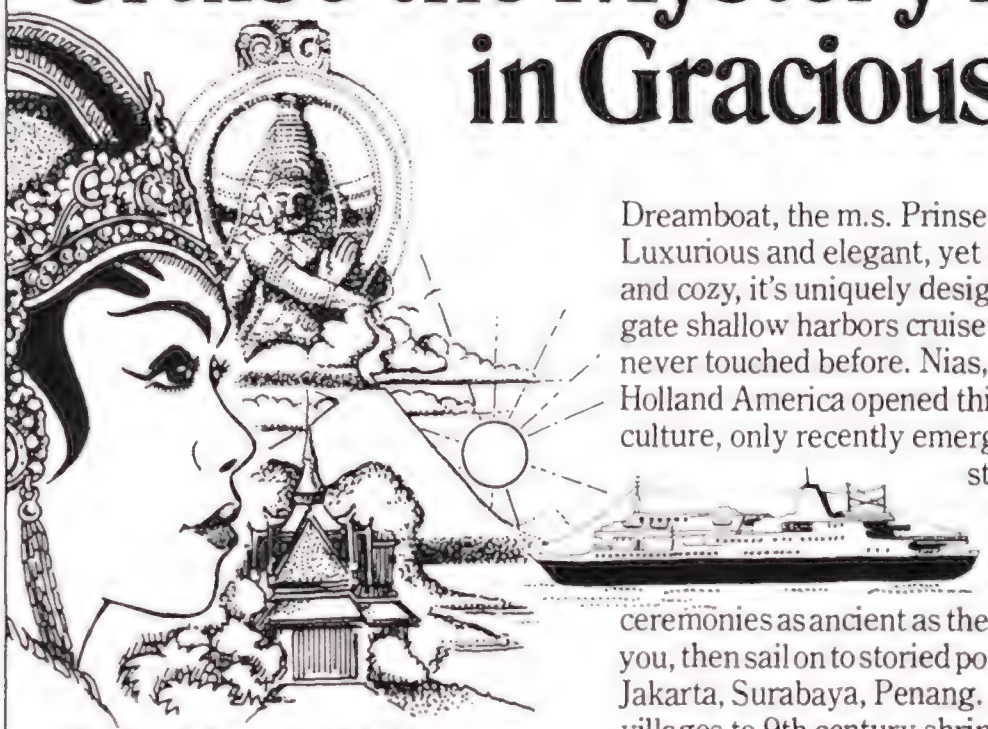

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(see Around the Mall, September 1976).

Ben, who is a big guy with a shock of white hair, says that he was raised in the staid family of an Illinois lawyer and firmly guided toward a profession. The trouble was, young Ben liked drawing things and slipping off to the movies a lot better than shaping up toward the achievement of a proper career.

In 1953 Lawless came to the Smithsonian, bringing a healthy dose of iconoclasm with him. He says he was allowed to join the exhibits staff on condition that he leave in nine months. He's still there, pacing around a disorganized and mightily untidy office filled with posters, child art, busts, figurines, a boomerang on the wall. Here he dreams up exhibits, features, displays, all of which have that common denominator of being fun.

It isn't all easy. Ben says he has friendly but intense battles with scholars over such concepts as a museum of play. He suggests this sort of thing; the scholars say, "You've got to be kidding." But he's not.

I mentioned the delights of the Mall. He beamed agreement, allowing that it was coming along. He recalled when it was crossed by heavily trafficked roads and you couldn't cut across the grass without a cop shouting at you. Today it's Frisbees and kites. And fun.

Returning to *my* messy office, I passed the castle on the Mall and noticed a group of tourists staring silently up at its ivied walls. There, halfway up to the crenelations, was a gray squirrel. It was obviously tired, but it was determinedly struggling from one branch of ivy to the next, hauling itself toward the still-distant roof. Sometimes it would lose its footing momentarily and slip down.

At last the squirrel reached an overhang just below the topmost battlements. All of us in the growing crowd of watchers looked at each other solemnly and shook our heads. This final obstacle would prove too much for the weary animal, we were sure. It would never make it, we told ourselves, sorrowfully.

Yet it did it, without benefit of piton or belay. It negotiated the outcropping with heart-stopping skill and courage, dragged itself through the crenelations, and appeared above us for a moment, standing atop the castle roof, exhausted but triumphant, seeking a new height to conquer but finding none. We all spontaneously applauded, half expecting a

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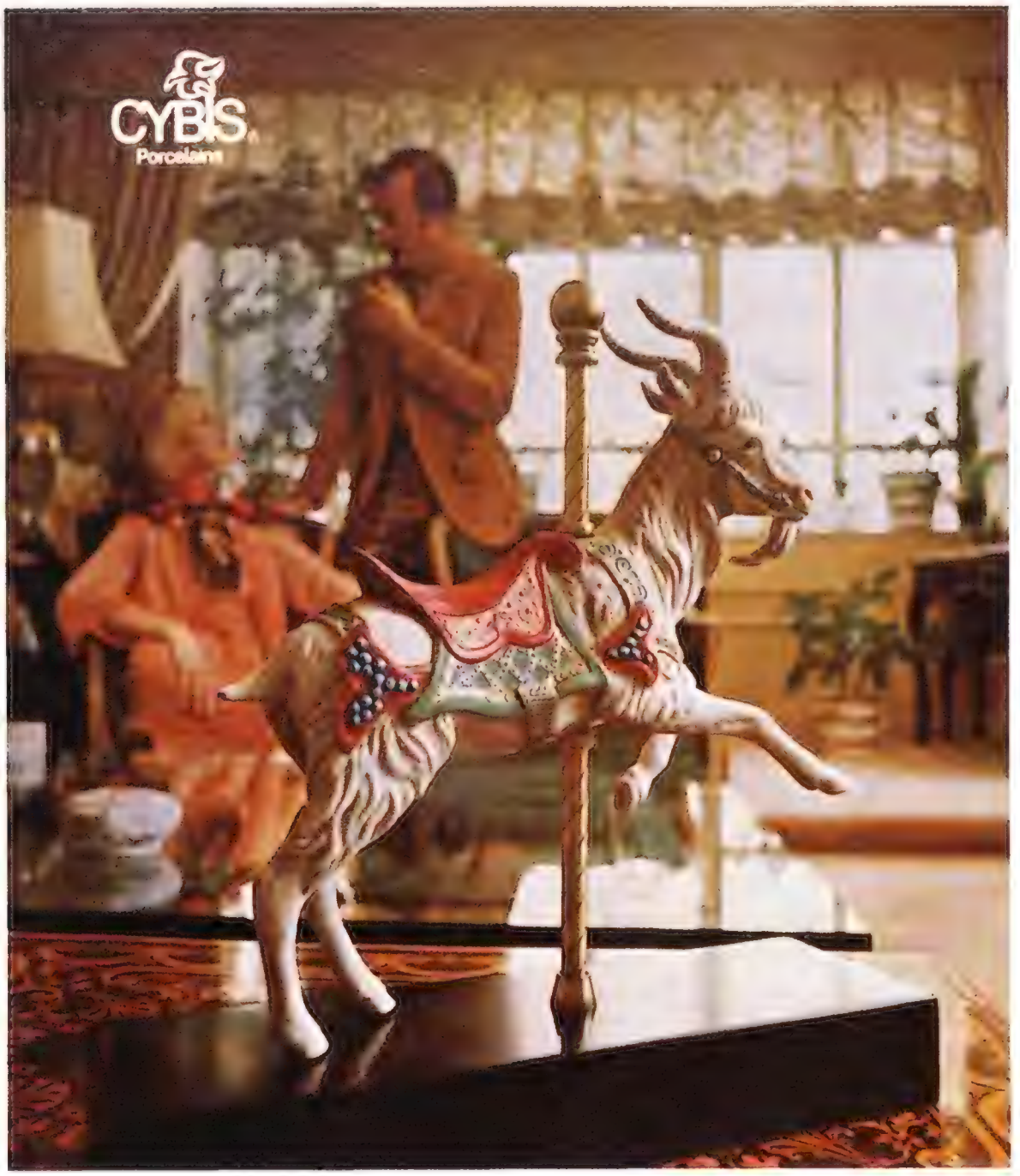

The first time we met she said I really got her goat.

The feeling was mutual. We disagreed about everything. Spent hours proving each other wrong. And sometimes I took the opposite side just for the fun of it. Then, one day, we both burst out laughing at the same time.

Ten years of marriage have uncovered certain areas of agreement. We both love old merry-go-rounds, peanut butter and jelly, Victorian furniture and being quiet with each other more than debating with anybody else. And now the goat we've got is neither hers nor mine, but ours.

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small squirrel flag to rise and snap in the clear air of that great height.

I walked away, pleased, yet bothered: that indomitable and athletic squirrel had carried no acorn in its little rodent teeth; it had not returned to a family nest in the rainspout; it had not a purpose in the world for all that outpouring of courage and energy. Couldn't someone have tied a small fishline to the tail so it could have hauled up a TV antenna? Couldn't it have been trained to rout nesting pigeons from the window ledges? All it had accomplished by the climb was to build up a few muscles that might help it live 15 minutes longer. Nothing for the good of Mankind—or Squirrelkind.

My mind instantly moved to the scores of joggers who pad past the Smithsonian buildings every day around noon. Here they come, pleasingly dressed in striped sweat pants or shorts, clear of eye, pink of cheek, sturdy of leg. And there they go, sweat coursing down their faces, lungs wheezing with renewed health, hearts thumping with a vigor that will surely last for a century more, minds dimly focused on the completion of two miles, three miles, whatever is demanded.

All that energy is not helping *me* a damn bit. The panting breaths and steaming bodies do not warm the air appreciably on a cold day; the pounding legs do not turn giant fans on a hot one. The activity is dull to watch, fosters no sense of grace and is remarkably painful for its participants. Even the very word "jog" is uncomfortable to say. Try it a few times out loud and notice the small pain that develops behind your right eye.

I suggest that joggers carry mail. Have a lightweight pouch handy, filled with high-priority messages from the National Air and Space Museum to the Museum of History and Technology. Drop it over a jogger's shoulder as he pads by. Have someone hook it off when he passes the address. Simple. Costless. From the Freer to the National Gallery in 12 minutes instead of three days, thanks to a Marine Corps major battling his corporation. From the Capitol to the Department of Agriculture in 20 minutes, thanks to a 35-year-old Congressman steaming out the effects of last night's Georgetown dinner. Efficient. Nonpolluting. A splendid untapped reservoir of energy, Mr. Carter.

—Edwards Park

[Mr. Park's book, *Nanette,* has just been published by W. W. Norton & Co.]

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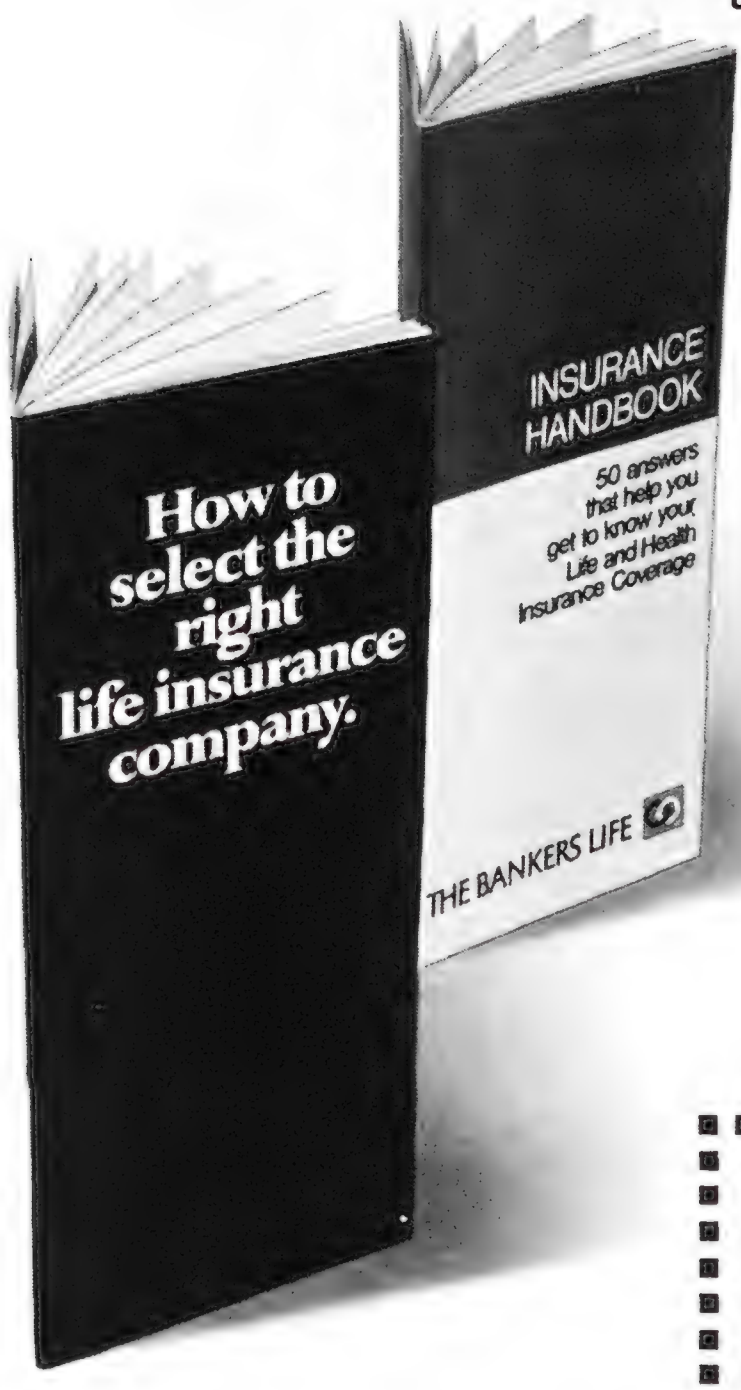
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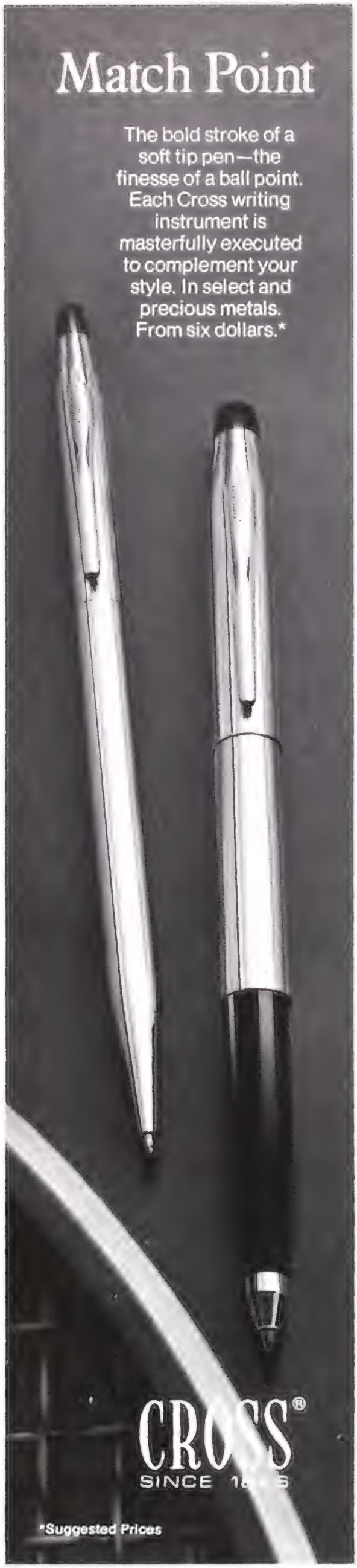
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Letters to the Editor

Tulipomania

Dear Sir: My husband and I enjoyed your delightful April cover story on 17th-century tulipomania. It is reassuring (in a way) to know that fads, booms and busts are not 20th-century phenomena.

I noticed that the author placed the probable origin of the tulip as somewhere in the northern Himalayas or the Pamirs. I think I can confirm this. My husband and I recently spent several years in Islamabad, the pleasant new capital of Pakistan. Islamabad is located at the very edge of the Punjab plain, with the foothills of the western Himalayan ranges and the Karakorams immediately to the north of the city. The base of these steep hills was only about 200 yards from our front door. A favorite pastime was a Sunday hike over the many miles of trails the Pakistan government has laid out in the hills.

Each spring in Islamabad, we found the open spaces along the crests of these hills bright with small red-and-white flowers. They grew from bulbs, were shaped like slender, long-petaled tulips, and had tuliplike leaves. A Pakistani friend told us they were wild tulips.

We found tulips at 1,500 to 3,000 feet, but they seemed to go on from there up toward the distant mountains.
Susan H. Ingraham
Bethesda, Maryland

Dear Sir: Terry Berger's article seems to have relied so heavily on Wilfrid Blunt's book, *Tulipomania*, that it is unfair not to have given more credit than just a listing in your "Additional reading."
William H. Rhodes jr.
New York City

There are a number of similarities between Blunt and Berger, and the author says she did rely heavily on his book for historical information. But she says she used half a dozen other sources. Ed.

Kirlian photography

Dear Sir: Edward Edelson's article on Kirlian photography gives an excellent overview of the subject, but there is an inferred generalization about parapsychologists that seems quite unfair.

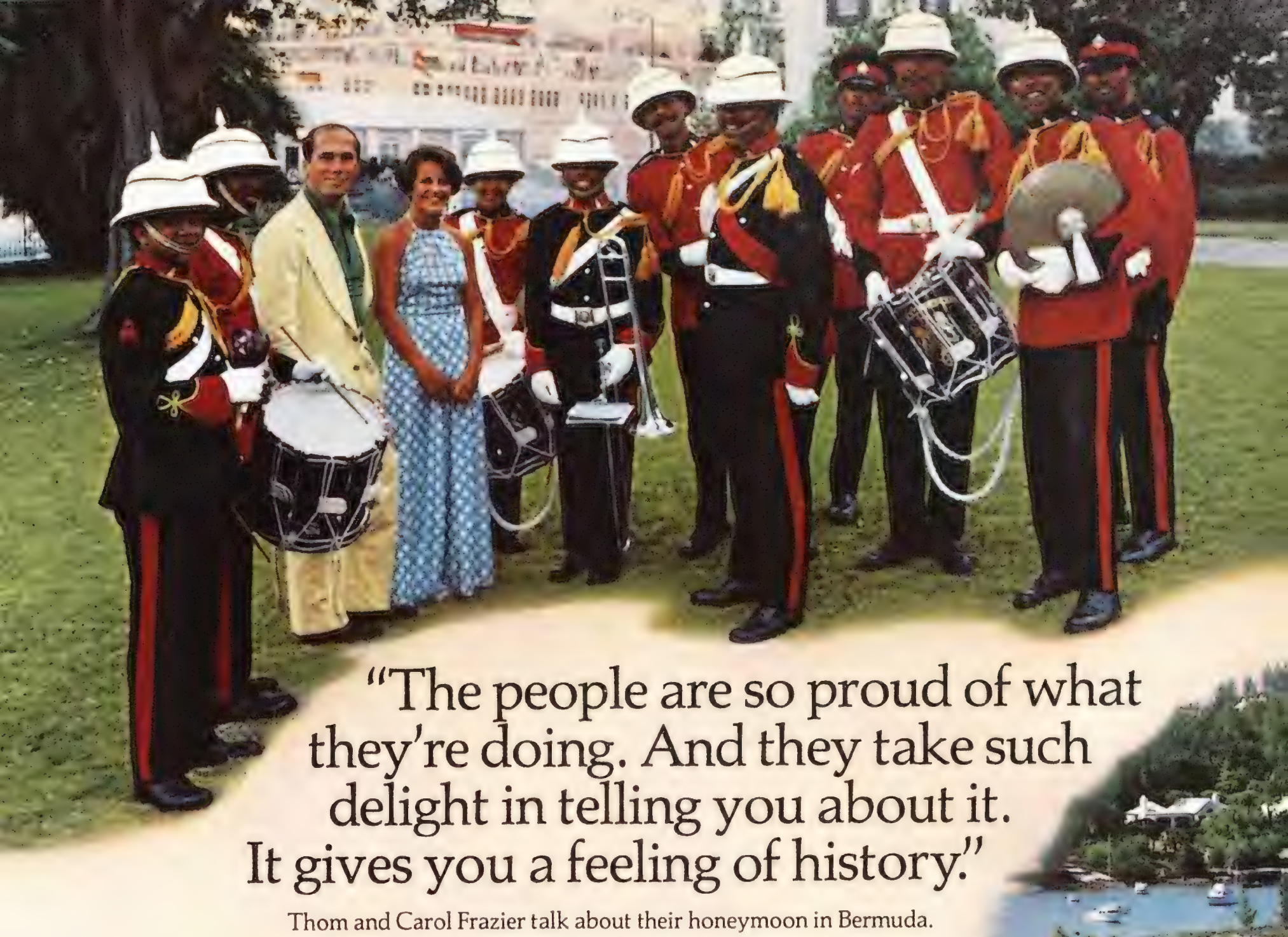
While taking seriously the "hard-science people" who are investigating Kirlian photography and looking for physical causes for the phenomena, Edelson contrasts them with "groups and individuals prominent in parapsychology, who are cheerfully willing to entertain the notion that they are dealing with all sorts of psychic phenomena, not excluding the always elusive human soul."

Parapsychologists come in all shapes, sizes and viewpoints. Many could be described as "hard-science people" (physicists, geologists, mathematicians) who do not equate Kirlian photography with the paranormal.
Diana Robinson
Weston, Connecticut

Quasars

Dear Sir: The intriguing article by Sterling Seagrave indicates that observed redshift limit for quasars of 15 billion light years gives the time into the past before which galaxies, and hence quasars, had come into being. In this he is quoting Allan Sandage of Hale Observatories, who suggests that the universe is approximately 17 billion years old. He further points out that the 15-billion-year limit is observed when we look in various directions from the Earth.

If this is the case, then we can imagine two quasars that are seen in opposite directions from the Earth, which are then some 30 billion light years apart. Considering this case, and furthermore the assumption that our universe originated in a Big Bang, it would seem that for the quasars to get into the position we now see them as of 15 billion years ago would have taken another 15 billion years from the original Big Bang. This suggests the universe is nearer 30 than 17 billion years.
Donald F. Wilcock
Latham, New York



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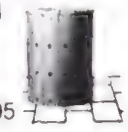

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Not only have the quasars been moving away from us since the Big Bang, but as the whole universe has expanded like a raisin pudding rising, we have been moving away from them at equally high velocities. Thus the combined distances measured in light years are greater than the time in years. The geometry is complicated by the fact that the distance light must travel from the quasar to Earth has been constantly increasing as the universe expands. Ed.

Jade

Dear Sir: We were pleased that Paul Desautels chose as one of his illustrations a fine carving of a jade jar made from a single boulder of Alaskan nephrite. This is one of a pair of vases, now part of the Lizzardo Museum Collection. It has special significance, thanks to a complete provenance.

We have a carefully documented history, complete from boulder in situ to positioning in a display case. We know who discovered it (George Van Hagen), the difficulties encountered in bringing the boulder to civilization, the name of the artist who fashioned the vessels (T.C. Chang), and the history of prior exhibit.

Horace A. Greene
Lizzardo Museum of Lapidary Art
Elmhurst, Illinois

Prior to Lizzardo's acquiring them, the two Alaskan vases were on loan to the Smithsonian, but the Institution failed to raise the money to buy them. Ed.

Airships

Dear Sir: In Kurt R. Stehling's article, "A new age of airships may dawn," he states that the *Los Angeles* (a German-built Zeppelin) was dismantled in 1932. The *Los Angeles* was decommissioned on June 30, 1932, but dismantling did not take place until October 29, 1939.

Frank J. Regan
Aerospace Engineer
Naval Surface Weapons Center
White Oak Laboratory
Silver Spring, Maryland

Mr. Regan is correct. Ed.

Soane Museum

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museum, we were told by a friendly attendant that for months a gentleman had been visiting the museum for about 15 or 20 minutes during his lunch hour each day and contemplating just one object each visit. But the best we can do is to go to Soane's at least once each time we are in London—each time discovering new treasures. Your article gave us a number of undiscovered items to anticipate.
Carlton H. Larrabee
Fresno, California

Lawns

Dear Sir: As a commercial farmer, trying to maintain a suburban-type lawn around my house, I read John H. Falk's article with no little interest. But an error throws all the conclusions in the article into doubt in my mind.

If Dr. Falk spends 2.5 percent of 22,500,000 Kcal in physical labor on his lawn per year, he would average 1,541 Kcal per day. That is about five hours of hard labor per day, which is hard to believe from even the most ardent suburban grass grower.
Rollie L. Cavaletto
Nipomo, California

Dr. Falk wishes to express his appreciation to Mr. Cavaletto for spotting his miscalculation, and explains that it came about this way: "Total physical labor did, in fact, represent 2.5 percent of the total management energy input, but it should have been 2.5 percent of 205,000 Kcal/year—not 22,500,000. The discrepancy arose when, instead of expressing the results I originally calculated as Kcal/-m²/year, I felt a more meaningful expression would be Kcal/year for my entire lawn. My lawn was 110 m²; therefore multiplying the results by 110 should have yielded the appropriate answer. Unfortunately, I mistakenly multiplied by 110 twice, causing the error." Ed.

Dear Sir: Obviously, Dr. Falk must be childless. As anyone who has purchased a brand-new home in suburbia, sans lawn, knows, the amount of dirt that can be tracked inside the home by small and big feet must result in 3,775 Kcal/m²/-year house management input.

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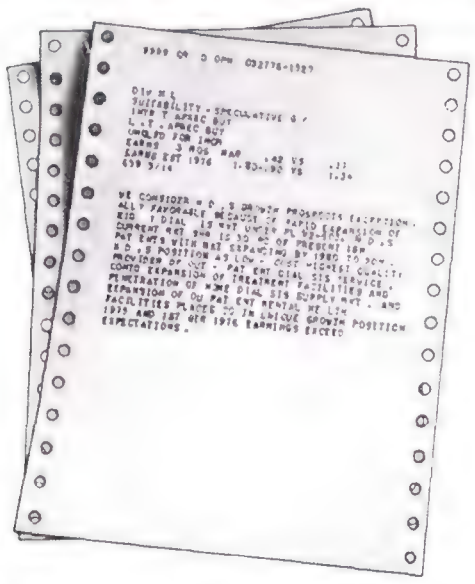

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Phenomena, comment and notes

What you were afraid to ask about Aztec diet, amino acids of early Californians, and a new musical code

Not long ago Denys Parsons, the head of public relations at the British Library, set out to provide a means by which one could identify tunes and musical themes one doesn't know the name of. All it takes is the pitch profile of the first 16 notes. The first note is called "*." If the next note goes up, you write U; if it goes down, you write D. If the third note goes up from the second, write U, and so forth. If the note is the same as its predecessor, it is designated R for repeat. Parsons profiled 10,000 classical melodies and 4,000 popular ones in a rare and unlikely book, *Directory of Tunes and Musical Themes,* published in England.

*UURDU DDUDD UDR is singularly and only *The Odd Couple*, whereas the similar but ultimately altered profile, *UURDU DDUDD DUD, is *Lizzie Borden* of "You Can't Chop Your Poppa Up in Massachusetts" fame. Make a couple of more changes and you'll come up with *If I Knew You Were Comin' I'd 'ave Baked a Cake.*

No doubt this book has proved valuable for breaking up barroom scraps, as has its rich cousin, the *Guinness Book of World Records,* but this kind of success was not nearly enough to ease Mr. Parsons' restless mind.

He set out to examine the first three notes of 7,387 themes of 30 major composers from Bach to Wagner and reports, in *New Scientist* (Vol. 73, No. 1044), a remarkable unanimity of preference. Twenty-two of the 30 "put *UU in the first place and no less than 26 banish *DR to bottom place."

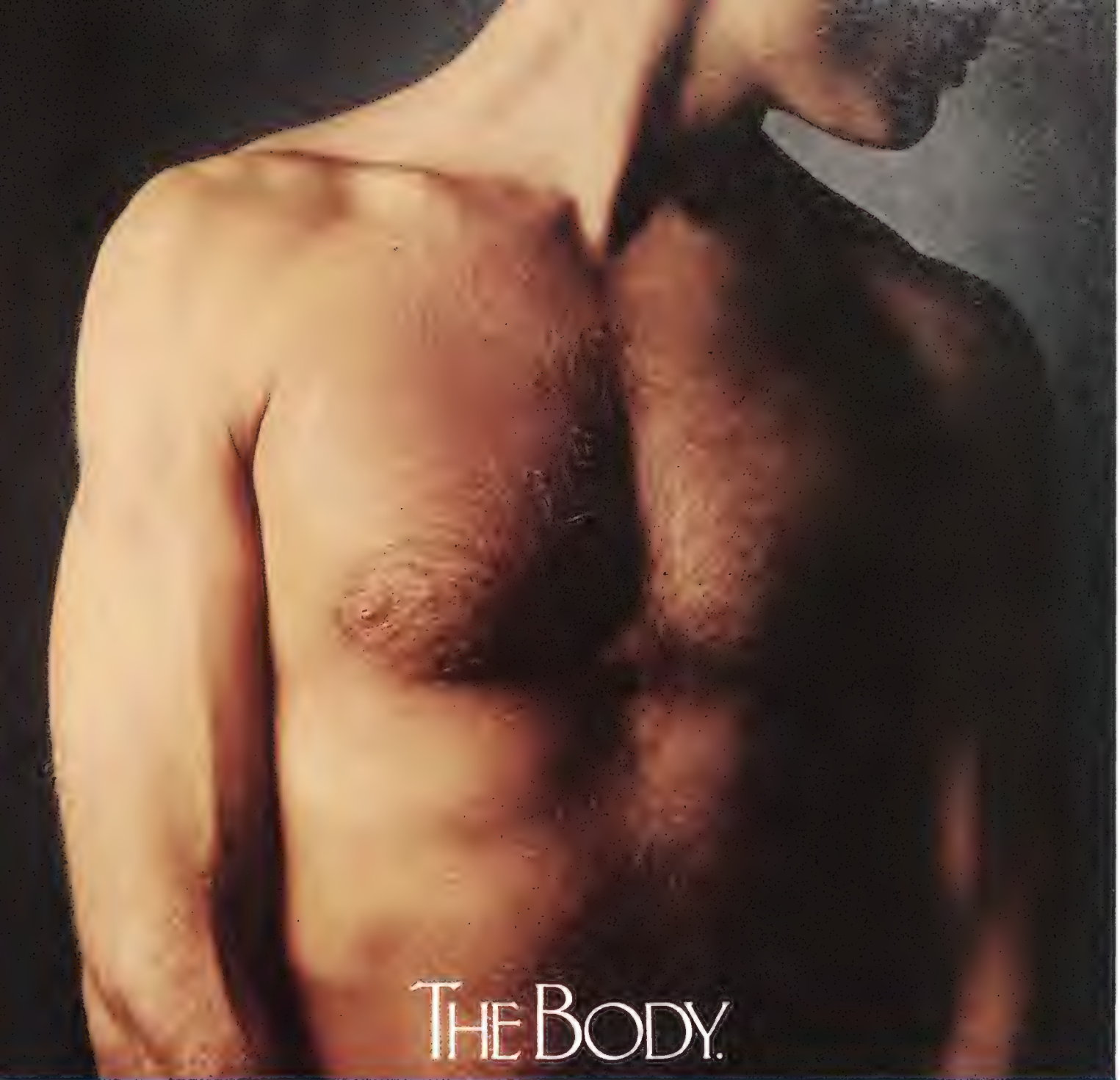
Mr. Parsons found 270 other classical composers and 3,763 popular songs that show the same order of preferences. Just what to make of all this, he does not say.

The Mexican connection

Reporters spoiled by the unfolding of Watergate are more than ever on the lookout for coverups, and daily they hungrily probe the most innocuous of crannies for dirt—often with little effect. Some exposés are, of course, serious, such as the Congressional Korean connection.

But what investigative reporter has been assigned to the long-term coverup of the anthropological Mexican connection? The matter under discussion here has been known since early in the 16th century but, as Michael Harner writes in *Natural History* (Vol. 86, No. 4), it has been "unconsciously covered up" by modern Mexicans and by anthropologists, "the former partly for nationalistic reasons; the latter partly out of a desire to portray native peoples in the best possible light."

The Aztecs, creators of that wonderful and mysterious civilization south of the border, are widely known (though not in all elementary school texts) to have practiced human sacrifice. The latest estimates are that these civilized folk sacrificed one percent of the area's population each year—some 250,000 people per annum—to their hungry gods. A religious aberration, you may think, but if our anthropological Woodstein, Mr. Harner, is correct, the Aztec religion was akin to



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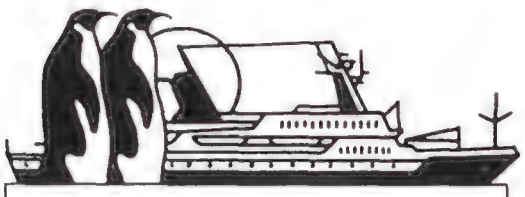

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In a 16th-century drawing, Aztec priests are cutting out a youth's heart.

the Haldeman-Ehrlichman "national security"—it arose as an excuse for what was perceived as an administrative need. What, asks Harner, did they do with the bodies? The answer lies in a census of mammal species in Middle America.

Uniquely, among major civilizations, those in pre-Columbian Mexico arose in an area where there were few—nearly no—domesticable herbivores, thus leaving a burgeoning population without the needed combinations of amino acids in their diets.

Vegetarians, calm down: 16th-century chroniclers say that the Aztec poor rarely could eat maize and beans simultaneously because of regular crop failures. The rich imported game from the far reaches of the empire.

How then to feed the masses? With people. Early records describe sacrificial victims being relieved of their hearts high atop the steep-sided temples, their bodies then being kicked over the side to tumble to the masses below. Archaeological discoveries show racks of skulls with holes for the extraction of the brains—a delicacy for the priests—as well as caches of bodies from which the limbs had been carefully removed.

Harner suggests that cannibalism, well documented in early records, arose in Mexico in response to ecological needs, and powered both religious and political life. The gods' appetites increased to demand sufficient numbers of human hearts. The political system, which allowed nearby Tlaxcalan to exist without

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its conqueror's administration, was part of an empire based on cannibalism. Tlaxcalan was "preserved as a stockyard" to supply meat to the warlike Aztec raiders. The poor were willing to serve in the raiding parties because anyone who caught a "prisoner" single-handedly several times earned the right for himself and his descendants to supplement their diets with human flesh.

Even architecture reflected the power of this grisly social force. The temples of the Aztecs (and the Toltecs before them) were very steep-sided. All the better (says Harner), to tumble the bodies down to the ravenous city folk below.

The first Californians

Speaking of amino acids and early Man in the New World, a geochemist named Jeffrey L. Bada at the Scripps Institution of Oceanography said, three years ago, that he had evidence that people were in California some 48,000 years ago. Just about everyone scoffed, since the accepted—but hotly debated—time for human arrival upon the North American scene was a maximum of 20,000 years ago.

Dr. Bada was employing an unorthodox method to reach his unorthodox conclusion. It seems that in all living things the amino acids that make up the proteins are in what chemists call the left-handed form: the L-isomer. Over the stretch of geological time the L-isomers are changed into right-handed forms, the D-isomers. This transformation process continues until the mixture contains equal quantities of L- and D-isomers: a racemic mixture (a term first used by Pasteur in the 1840s), achieved in about 300,000 years. The process runs faster or slower in geographical areas of different temperatures. Thus, by measuring the ratio of left- to right-handed isomers, and taking climatic temperature into account, you can determine the age of a fossil. For fossils whose age can also be estimated by radiocarbon techniques, Bada's results are within an average of seven percent of the accepted results for some 25 sites throughout the world, he says.

Bada feels that he "kicked the sleeping horse" of human-arrival estimation back in 1974. He notes a tremendous surge of interest among archaeologists these days in the 40,000-to-50,000-year date.

But carbon-14 dating, we learn from *Science News* (Vol. 111, No. 13), is good

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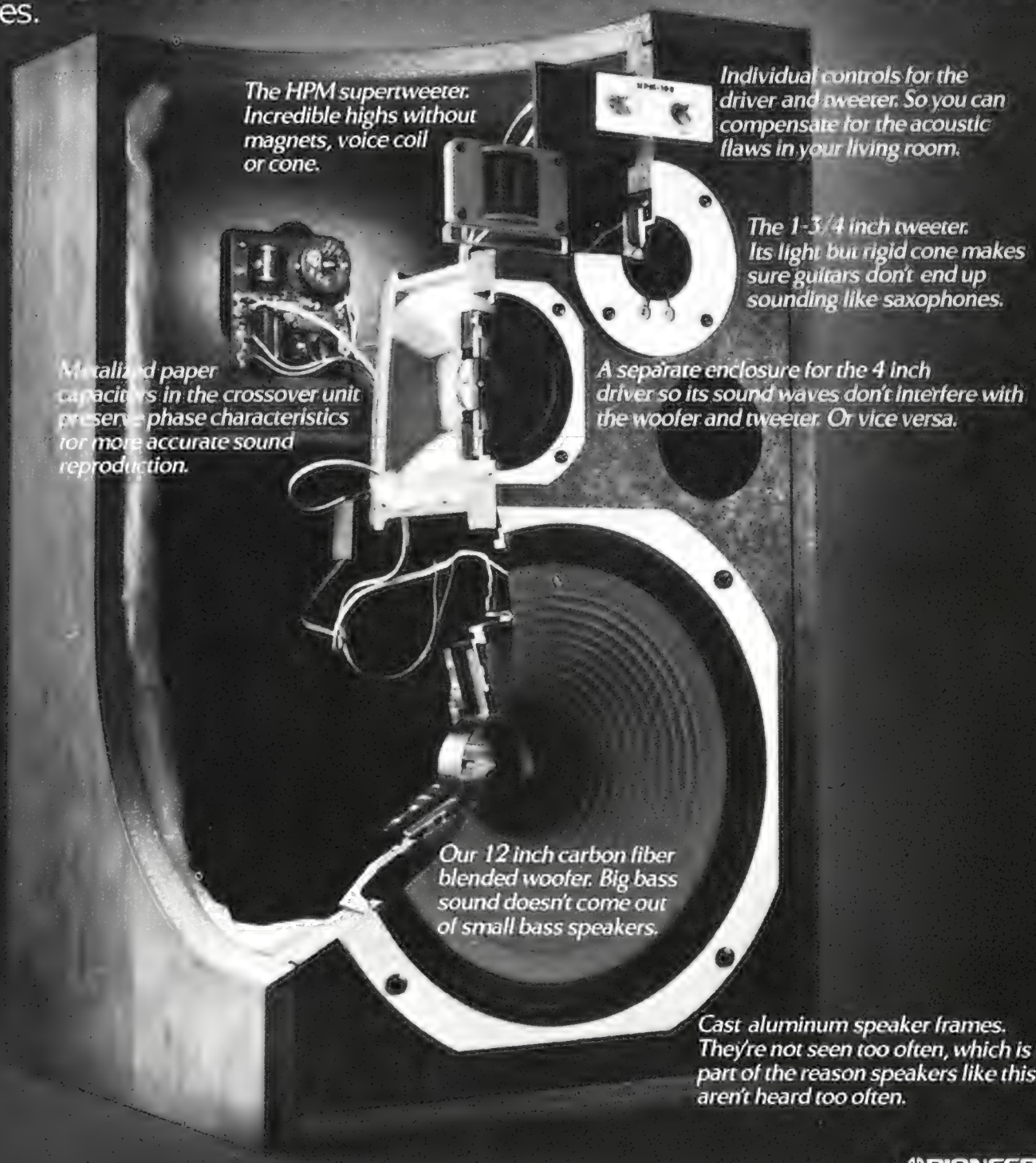
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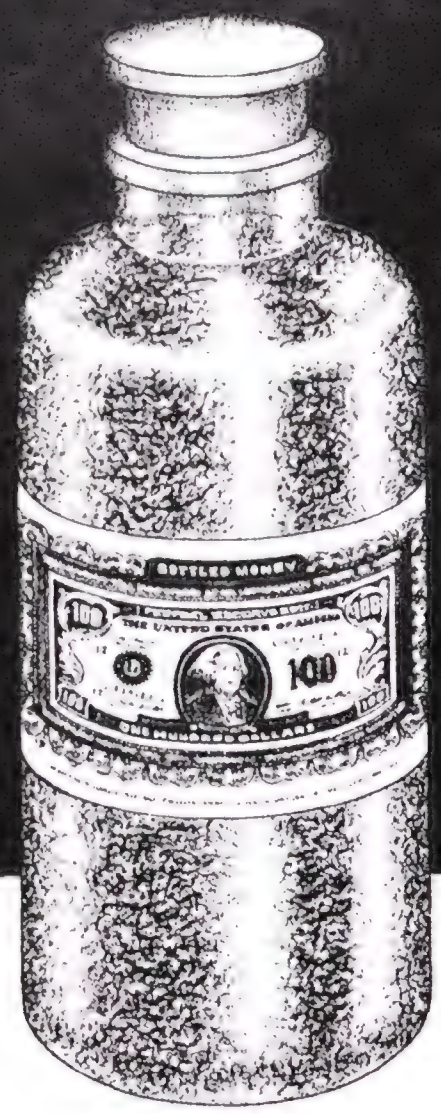

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for only 40,000 years. After that passage of time all measurable C 14 is gone. Now, that journal reports, along comes UCLA archaeologist Rainer Berger, who, on California's Santa Rosa Island near Santa Barbara, found a hearth containing a bone from a mammoth and what he felt were the stone tools of Man. Carbon-dating these, Dr. Berger says that there is no measurable C 14 in them. So men *were* enjoying the Golden State's fabled climate at least 40,000 years ago; that was the middle of the last Ice Age, though, and it probably left a little bit to be desired.

Berger wasn't surprised at the absence of human remains along with the mammoth bone and tools—it's unlikely anyone would die at the eating place. But human bones are presumably nearby.

Our ancient home

On the subject of age, and while our nose is buried in *Science News* (in this case Vol. 111, No. 14), scientists at the University of Chicago have used a method worked out at the Lawrence Livermore Laboratory in California a year ago to confirm what astrophysicists have been suggesting for some time (SMITHSONIAN, April 1977)—that the universe is about 20 billion years old.

The figure—for all you dating buffs—was arrived at by the use not of carbon 14 or amino acids but of rhenium 187. Rhenium 187 has a half-life of 40 billion years—meaning that in 40 billion years half of the rhenium 187 present in some object will have broken down into something else (for carbon 14 the half-life is a paltry 600 years).

From there it's all completely straightforward. You simply figure out how much rhenium 187 there once was, figure out how much is left, do a few simple arithmetical calculations and you get 20 billion years. Piece of cake.

—JAMES K. PAGE JR.

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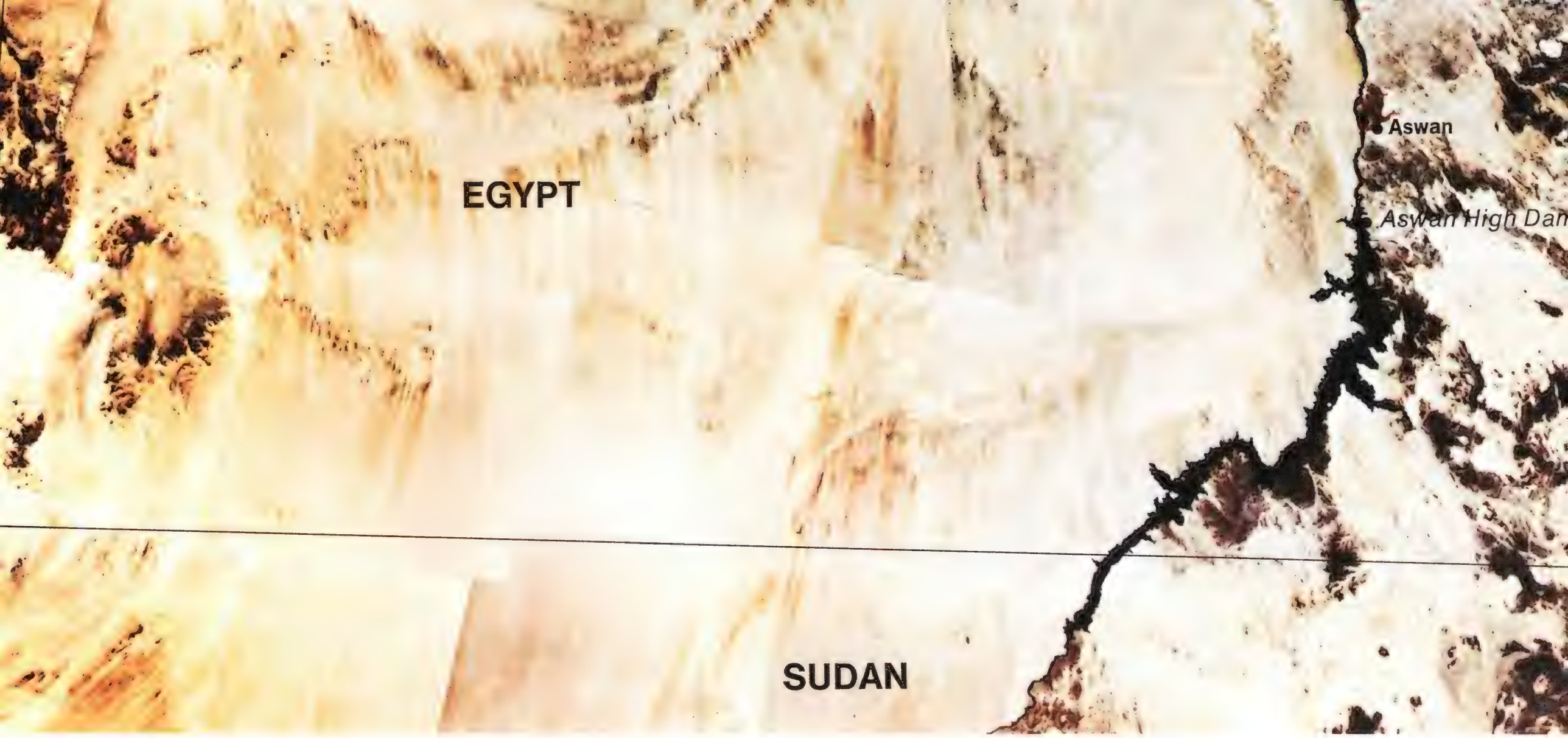

Streaks of wind-propelled light- and dark-colored sand, migrating from top to bottom in picture, advance through the Western Desert of Egypt in this mosaic of images from the Landsat satellite. Dark areas are depressions and oases. Farmland along the Nile appears red because infrared film was used.

By Farouk El-Baz

Expanding desert creates grim beauty but also threatens crucial cropland

Matching space photographs to what they find on the ground enables geologists to know how and where sands are moving

The grim threat of shifting sands

Mesquitelike plant, held in place by a massive root system, keeps growing out of the sand it holds.

In the Western Desert of Egypt "the free interplay of sand and wind has been allowed to continue for a vast period of time, and here, if anywhere, it should be possible in the future to discover the laws of sand movement, and growth of dunes." So wrote R. A. Bagnold in *The Geographical Journal* of 1933.

Bagnold was correct. To this day, geologists have been following his lead to gain a better understanding of the awesome and occasionally mysterious desert environment. This understanding becomes increasingly significant when we realize that dry, barren and sometimes sandy deserts constitute a fifth of the landmasses of the Earth. Moreover, desert regions are steadily growing. Tunisia, for instance, has lost something like half its arable land.

The Western Desert occupies 265,000 square miles, or more than two-thirds the area of Egypt. It lies west of the Nile River, its flat surface crossed by parallel belts of linear sand dunes. The largest concentration of these is known as the Great Sand Sea, which covers nearly 45,000 square miles. The flat terrain is also broken by depressions that enclose several oases.

My trip to the Western Desert was inspired by Apollo-Soyuz observations. The American astronauts of this 1975 joint venture between the United States and the Soviet Union studied and photographed parts of the desert. The photographs showed zones of color that did not correspond to boundaries of mapped geological formations. After studying the photographs, I traveled to the Western Desert in the company of five geologists from Ain Shams University in Cairo. We wanted to unravel the origin of the differing color zones and study patterns of sand movement and resulting landforms, many of which are analogous to wind-blown features on Mars.

As a geologist, I must acknowledge that in comparison to other types of terrain, little is known about deserts. One reason for this may be that the founders of the earth sciences in the 18th and 19th centuries were Europeans, and Europe is the only continent without deserts. Another possible reason is that deserts are vast, usually remote and inaccessible areas where harsh conditions prevail.

Consider the Sahara. It stretches across the entire width of North Africa and encompasses more than 3.5 million square miles. This is nearly one-third of the continent, and almost as large as the entire United States including Hawaii and Alaska. This is a lot of territory to study. Contrary to popular belief, it is not all covered by soft sand. Only about one-seventh is made up of sand dunes. The rest is barren rock and sun-scorched rubble.

Travelers of times past are credited with much of our scanty knowledge of the desert and its ways. No one traveled longer in the wastelands of North Africa and the Arabian Peninsula than the 14th-century Arab geographer Ibn Batuta. Starting in 1325, he spent 20 years meticulously recording his observations. After his time, little progress was made until 1788, when Sir Joseph Banks established the African Association for promoting the discovery of Africa. For nearly a century, the exploration of this continent captured the imagination of Westerners, much as spaceflight intrigued the world in the 1960s.

Red-yellow sand is pure enough and in some places deep enough for commercial mining; shovel gives scale.

Now spaceflight has opened another chapter in African discovery. The broad coverage of orbital photographs makes it possible for scientists to study features that cannot be recognized from an airplane.

Deserts are always clear of clouds and excessive haze, making it easy to photograph their features from above. Because they display a magnificent array of yellow and red colors, the use of color film enhances desert study. These color changes are scientifically meaningful. For example, geologists working in the Simpson Desert of Australia found that desert sand becomes redder with time; a thin film of iron oxide forming an inner coating of the sand grains is increasingly exposed as distance from their source increases.

The most important field objective was to study the meaning of color zones that showed clearly from space. In one photograph taken just west of the Nile Delta, we noticed three distinct zones that nearly paralleled the Mediterranean coastline. To study these zones, our two-car party started near the Pyramids of Giza. From there we followed the desert road north from Cairo to Alexandria and then west along the Mediterranean coast. Frequent stops were made to study the terrain and sample it. Our excitement increased as we tallied the findings. Utilizing the photographs, we were able to classify soil types, establish prevailing wind directions, and confirm the direction of shifting sands.

We realized that the darkest and southernmost zone owed its color to long exposure to the atmosphere. The zone may best be described as a desert pavement, with numerous pebbles coated with a dark varnish. This desert varnish results from the deposition from moist soil of a thin, often shiny, film of iron and manganese oxides on rock and pebble surface. In places the desert surface appears wavy. The varnished pebbles litter the high ground, whereas finer sands fill the basins to give the area a patchy, dark and light, appearance. Areas between pebbles serve as storage areas for sand during seasons of calm winds. When the winds increase, sand is lifted to fuel sandstorms.

The lighter zone to the north displays brighter yellow and yellow-red colors. It is covered primarily by a sand sheet that varies greatly in thickness from place to place. As the winds move the sand, it piles up in back of a bush, hill or other topographic rise. Desert plants appear here and there within this sandy zone, singly or in groups. These are not like the majestic saguaro cactus of the Arizona deserts, but are scrawny little stands of brush. Each clump of vegetation appears to be clutching the elusive sand grains out of fear of being swept away by the constantly howling winds. These bushes soften the bleakness of the landscape, adding some color to the yellow sands.

Desert plants also act as windbreakers. In the far reaches of the Western Desert near Siwa Oasis, a native shrub appears to have learned how to tame the desert. The plant, related to the mesquite, has roots that penetrate deep into the soil. As sand piles up around it to near submersion, its roots remain firmly planted while branches grow higher and higher, triumphantly emerging. Repetition of this cycle results in a ten-foot-high sand hill, capped with this rugged plant.

The zone closest to the Mediterranean displays a mottled, earthy-yellow color in the Apollo-Soyuz photographs. Its soil contains many clay particles in addition to calcium carbonate grains resulting from the breakup of limestone. Some of the clays are greenish; others are reddish. These clays increase the fertility of the soil because they hold the moisture longer than sand, thus allowing plants to establish roots. Some of the richest fig farms are in this zone west of Alexandria. Fig trees get all the water they need from winter rains near the Mediterranean coast.

Our field investigations proved that this arable zone extends all along the coast of the Mediterranean west of the Nile Delta. It averages about ten miles in width, and in places it exceeds 20 miles. To my knowledge, this is the first time that space photographs have been

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Dunes encroach on fertile land midway between Cairo and Aswan. The patches at right were bypassed.

The author examines the southern tip of one of the long dunes visible

used to point out and outline the extent of reasonably arable land where soil is reclaimable from the desert. The picture is not all rosy, however. The space photographs also reveal two patterns of shifting sands: longitudinal dunes and thin blankets. Both present dangers to fertile soil on the banks of the Nile farther east and south.

Continuing our journey by air, we studied many of the vast dune areas in the Western Desert, where conditions necessary to the formation of sand dunes are amply provided: absence of vegetation, abundance of loose material and moderately constant winds. Dunes may occur in forms called barchan, transverse, longitudinal and star. The crescent-shaped barchan dunes are formed by a moderate wind and a small supply of sand. The horns of the crescents point away from the wind. Similar wind conditions and a larger supply of sand form transverse ridges that line up at right angles to the wind direction. Strong winds of slightly variable directions and a large supply of sand result in longitudinal dunes. These are roughly triangular in cross section and are parallel to the principal wind direction. Longitudinal dunes whose crests taper to a sharp edge are called seif dunes, after an Arabic word meaning sword. Large, equidimensional star dunes form where the prevailing winds constantly change direction, resulting in the multipointed form. Smaller sand drifts are parallel to the wind, and still smaller sand ripples perpendicular to the wind also occur.

In the part of the Western Desert adjacent to the Nile Delta, Apollo-Soyuz photographs show dunes as individual streaks of light-colored material over the darker desert pavement. These are longitudinal dunes with crescent edges; some are more than 20 miles long and 20 feet high. This is not a small amount of sand, although by the standards of the Great Sand Sea a few hundred miles to the west, these dunes are infants. In that expanse of sand, enormous longitudinal dunes, called whalebacks, may be 100 miles long, two miles wide and 200 feet high; that is higher than some 20-story buildings. Fortunately, these whaleback dunes are relatively stable and do not migrate quickly.

Longitudinal dunes in the northern part of the desert are migrating southward in the direction of the prevailing wind, which is from the north. We compared photographs of the same dune taken at various times during the past two decades. These photographs show that the dune has migrated southward an average of two feet each day. One can stand near the southern tip of one of these dunes and watch it move. Grain by grain and layer by layer, the dune shifts along the direction of the wind. The motion is steady and generates a soft hissing sound. In parts of the Sahara, sand grains continuously climb the windward face, accumu-

in opening space photograph. Shapes of the dunes reveal their direction.

In this aerial view, sand is flowing around dark mountaintops, creating patterns also seen on Mars.

lating at the dune crests. As they avalanche down the steep slope, they sometimes generate a high-pitched musical sound or a roar, and the dunes are thus termed "singing" or "booming" dunes.

What is the origin of the sand composing the dunes? A quick glance at geological maps and orbital photographs does not reveal an obvious source. However, the gentle, northerly slope of the desert surface may provide a clue. There is evidence, both archaeological and geological, that the climate of the northern part of the Western Desert was more moist in times past. Rainfall may have washed weathered material downslope toward the Mediterranean. With increasing aridity, erosion occurs and the material is blown back toward the south. Another possible source is material removed during nature's carving of the depressions enclosing the oases, particularly the Qattara Depression.

The motion of dunes can present a hazard to Man's immediate environment. For example, the paved desert road from Cairo to Baharia Oasis, where iron is mined, is in the path of several of these longitudinal dunes. One of them has already reached the road and has begun crossing it. The blacktop must be constantly dug out from beneath shifting dune sand.

Farther south, midway between Cairo and Aswan, I photographed a generation of sand dunes encroaching on fertile soil. This encroachment is dangerous, since Egypt is a poor country that cannot afford the loss of productive lands. The situation is put into focus when we realize that the irrigated portion is only four percent of the total area; the rest of Egypt is barren desert.

The encroachment of sand dunes can be stopped by several techniques. One that has been successfully tried in Saudi Arabia is to spray the sand with a grain-cementing agent that holds the dune in its track. Another effective way is to plant eucalyptus trees in the path of sand-carrying winds. These slender Australian natives grow to great heights of up to 300 feet in desert environments. Their presence disturbs the advancing winds and causes them to unload the sand. Eucalyptus trees are currently being used to stop the desertification of arable land in a 900-mile belt of the Algerian Sahara called the Great Barrier.

In the field we immediately recognized that the southern tips of the longitudinal dunes are made up of numerous crescent-shaped dunelets, or barchan dunes. These appear to be formed by subsidiary winds from the west and northwest, because the arms of the crescents point to the east. The sinuous crests of these dunes display an unending array of patterns that record minor shifts in local wind directions. These crests separate two sides of the dune that invariably display different colors. The side facing the wind is darker, usually redder, than the leeward side, because the wind

sorts the grains as it moves them. Darker grains, which are usually coarser and heavier, stay behind, while bright-colored fine grains move easily to the lee side.

Most people believe that all dunes are made up of "quartz" sand, the variety that many of us are familiar with on beaches. Dunes can form from sand-sized grains of almost any rock, however. Dunes in Bermuda are made up of pink coral grains while others are covered with black magnetite particles.

The Apollo-Soyuz photographs reveal another pattern of shifting sands—not as dunes, but as broad streaks of thin sand sheets. These sheets often spread eastward from the southern tips of the longitudinal dunes. They appear to form as a result of strong subsidiary winds from the west and northwest, which cause sandstorms. When the storms subside, the grains settle on the ground in the form of thin blankets of sand that may be only a few inches or less in thickness.

Most of the windblown features in the Western Desert are common to other large desert regions. In fact, they are also common on Mars. Dunes, in particular, repeat their forms with astonishing regularity. If dropped amidst dunes in the Great Sand Sea, the Simpson Desert of Australia or the Kalahari Desert of Southern Africa, the most skillful geologist could not place himself. Dune crests would tower all around, with sand grains reddened by iron oxides. That same geologist might not even recognize that the surrounding dune field was on the planet Mars, except for the pink sky above the horizon.

As revealed by spacecraft, dunes and other windblown features are abundant on Mars. In fact, the largest single dune field that we know of in the solar system is the one that surrounds the icy north polar cap of Mars. This field must have formed as a result of strong polar winds that carried and redistributed in dune forms particles left by retreating ice caps.

I have found several correlations between dunes on Earth and Mars. For example, Apollo-Soyuz photographs reveal a little-known field of dunes enclosed between mountains in the Monte-Patagonian Desert, near Vallecito, Argentina. This field is morphologically similar to dunes photographed within a crater in the Hellespontus region of Mars. Both fields are identical in size: 34 miles in length and 22 miles in width. Another example is the light-and-dark colored streaks photographed on many parts of the Martian surface. The streaks appear to have formed as a result of deposition of particles carried by strong winds whose patterns are disturbed by crater rims. They are very similar to sand streaks in the southwestern corner of Egypt (p. 39). Both appear to have developed owing to the disturbance of sand-carrying wind by topographic highs; mountains in the case of the Earth, and craters in the case of Mars.

Correlation of dunes on Mars with similar features on Earth will help us unravel the nature of Martian landforms and the history of their development. We must first understand windblown features on Earth, however. The study of the Western Desert of Egypt is only a beginning. The results must be viewed as only scratching the surface of a large, unexplored territory. The Western Desert cannot be considered apart from the Sahara as a whole. What happens in the rest of North Africa affects the Western Desert and vice versa. This becomes increasingly important when we consider that much of sub-Saharan Africa is presently being desertified. The process goes on along a 4,000-mile belt winding from one side of the continent to the other. The desert-encroachment belt includes parts of Sudan, Chad, Niger, Mali, Algeria and Mauritania. Lack of rain, uncontrolled grazing, slash-and-burn agriculture, overcultivation and shifting sands from the north are all active in the desertification of fertile regions and pasture lands.

We are now at a stage where we must acquire a better understanding of the desert environment and of the ways and means to tame it, lest more areas of the Earth become lifeless wastelands. One tool that is at our disposal is photography from space. NASA's new project, the space shuttle, may provide us with the required information. Greater knowledge of the deserts, the directions of their growth, and the location of their reclaimable parts will be of both direct and indirect benefit to all Mankind.

Animal footprints crossing a tire track are deeper inside the track. Passage of a heavy vehicle has disturbed natural packing of the sand and left it looser, contrary to what might be expected.

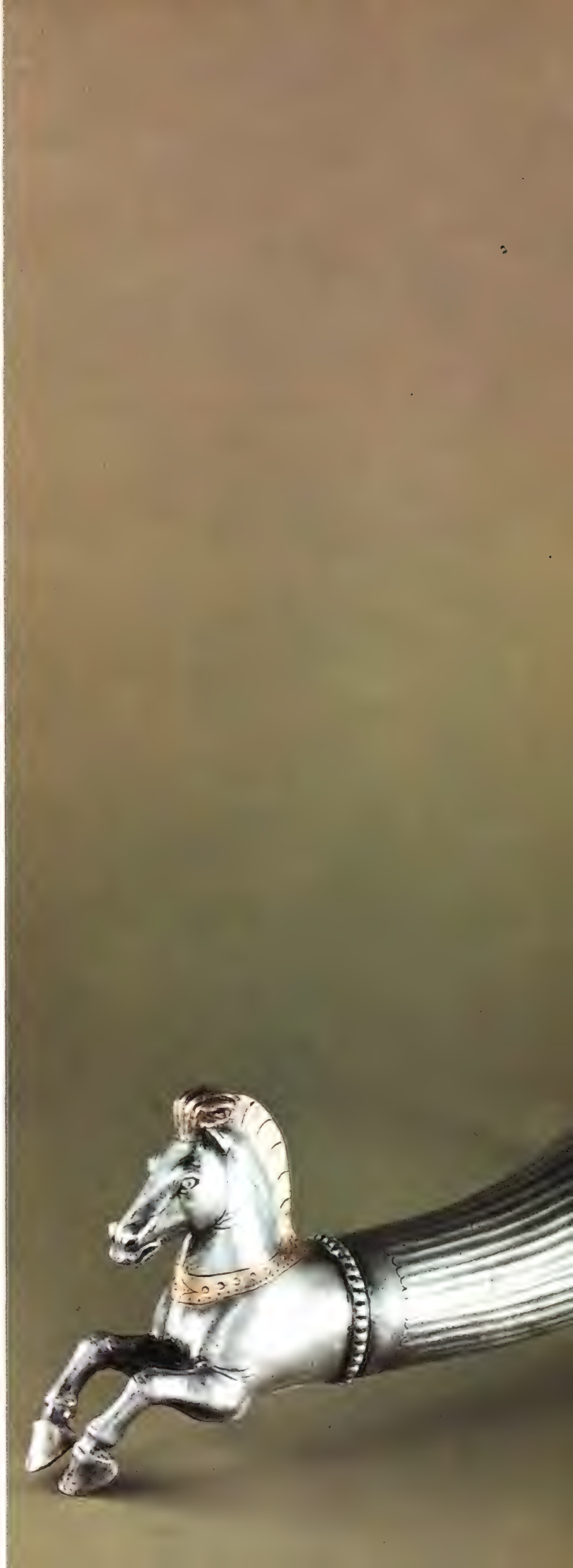
By Tom Prideaux

Rich and rugged Thracian life seen in a glittering show

'Cowboys' of ancient world reveled in gold and silver objects—at Metropolitan Museum of Art this summer, on loan from Bulgaria

Like trumpet calls on a shifting wind, our knowledge of Thrace has come to us in tantalizing, fitful gusts. The ancient Thracians had no written language of their own. Therefore we have had to fall back on tales from their Greek neighbors, on Homer and Xenophon, on references in Greek plays and, to be sure, on the superbly nosy Herodotus. By bits and pieces, the Thracians have emerged as a sharply original people, split into rugged tribes, given to hunting, stock-breeding, battles and banditry, and to an almost sybaritic love of elegant gold objects. Above all, they were dashing horsemen, which may explain how they acquired, in their own times, something of the romantic charisma of the American cowboy. The early Thracians charged into recorded history with galloping hooves and the glint of gold.

Our patchy knowledge is being enriched this year by "Thracian Treasures from Bulgaria," an exhibit of several hundred objects: gold and silver ornaments for horses, pottery, armor and—not surprising for a wine-loving people—splendid drinking vessels. The show was sent by the People's Republic of Bulgaria, which can consider itself a descendant of Thrace, since it covers (along with European Turkey and a corner of Greece) roughly the same area as the ancient realm. Assembled from 25 Bulgarian museums, the exhibit has already been seen in London, Paris, Vienna, Moscow, Leningrad, Warsaw, Havana and Mexico City. It comes on June 11 to New York's Metropolitan Museum of Art, where it will run through September 4.



Archaeological Museum, Plovdiv

After that, possibly Canada and definitely Japan.

Most of the treasure was unearthed from palace ruins or grass-covered burial mounds. Similar mounds exist in other parts of Europe, but in Bulgaria they are, literally, almost all over the place. Some of the objects in the current exhibit, which covers a span of almost 6,000 years, were discovered as recently as 1974. Since the work of unearthing this ancient civilization is far from finished, it is entirely possible that today, while the reader is turning this page, an excited archaeologist in Bulgaria may be turning up some specimen of Thracian treasure.

According to Professor Ivan Venedikov, the Bulgarian archaeologist who helped organize the exhibition, the first rich culture (6000-3000 B.C.) belonged to an unknown and mysterious Neolithic people who appeared throughout the region spontaneously. They produced gold ornaments, figurines and pottery. But not until 1500 B.C. did identifiable rulers and gods of Indo-European origin take the stage, and the lively pageant of Thrace begin.

Its geography almost guaranteed a turbulent history. Wedged between northern Greece and what are now Romania and the Ukraine, Thrace had two coasts: one on the Aegean, the other on a corner of the Black Sea. If it may be said that seas have personalities, the two bodies were opposite types. The island-studded Aegean was a sociable sea, open to the Mediterranean, and aswarm with small-boat fishermen and other island-hoppers.

The Black Sea was stormier and more mysterious. In prehistoric times it had been a great brackish inland lake. The Greeks regarded the rich land of Colchis on its eastern shores as a hotbed of sorcery; it was Medea country, where the alluring witch slew her own children and flew about in a chariot drawn by serpents. Sailors dreaded its pounding breakers. At one time the Black Sea was named Pontus Euxinus (the hospitable sea), possibly to counteract its reputation. But Lord Byron, who knew how its rough seas could torture a sailor's stomach, told the truth in *Don Juan:*

> There's not a sea the passenger e'er pukes in,
> Turns up more dangerous breakers than the Euxine.

The Thracians had both seas running in their veins, and, moreover, they were separated from the mainland of Asia Minor by only two narrow straits, the Bosporus and the Hellespont (now Dardanelles), neither of them wider than a big river. By one means or another, Thrace was exposed to invasion by pirates, land-grabbers, traveling salesmen and wily skippers like Odys-

Silver rhyton (drinking vessel), fifth century B.C.
Wine flowed through hole between horse's legs.

Photographs by Lee Boltin

seus, or world-shakers like Darius I and Alexander the Great. Thrace was at a borderline between two civilizations, a tollgate between West and East.

The Thracians were formidable horsemen, quick to attack and quick on the getaway. It stands to reason, therefore, that most of their treasures would be small and easy to pack in a hurry.

Much of their gold and silver, as can be seen in the present exhibit, took the form of plaques or emblems that were attached to their horses' harnesses. These shiny ornaments, sparkling as the horses pranced, served a double purpose. They were status symbols, advertising the majesty and wealth of the riders. Also, decorated as they were with magical creatures—hippocamps, griffins, three-headed snakes—they protected both horse and rider from foul play or accident. Today we might stop to consider that rich car owners do just about the same thing, advertising their status with gold-plated radiator ornaments or other fancy fixtures, and ensuring their safety with images of St. Christopher or rabbits' feet.

Two major figures in Thracian mythology were the god Dionysus, whose image graces a silver pitcher in this exhibit (p. 50), and his follower, Orpheus. Unlike the Greeks, the Thracians had few gods, but Dionysus had a profound influence. When the cult of Dionysus—he was the god of vegetation, wine and drama—began to spread through the classical world, he became known as "the suffering god," whose life cycle included winter death and springtime resurrection. His bond with Orpheus stemmed from the time that Dionysus, migrating from Asia Minor, was saved from an assassination plot by a Thracian, Charops. In gratitude, the god gave Charops the strategically located Hellespont, which was later inherited by his grandson, Orpheus. Thus, by a deed of Dionysus, Orpheus became a legendary priest-king of Thrace.

A musician whose lyre tamed men and beasts and inspired stones and trees to dance, Orpheus embodied Man's creative ecstasy. During his trip to the Greek underworld to rescue his dead wife, Eurydice, the music of Orpheus, as Ovid wrote, "made the pale phantoms weep." And when Orpheus was chopped to pieces by some frenzied Thracian women, his severed head was flung into the sea, where it bobbed on the waves, singing. The cult of Orpheus, in its later forms, involved more sober religious concepts, such as eternal salvation earned by ethical behavior and strict self-denial. But in Thrace, Orpheus invited his followers to rejoice and celebrate life.

Did it occur to the Thracians that entry into the hereafter might depend on good conduct on Earth? In one tribe, as Herodotus wrote, "When a child is born, all its family sits around wailing over the woes it must endure, listing every ill that befalls humankind. When there is death, on the other hand, there is laughter and joking on behalf of the deceased who is certain of eternal bliss."

In another tribe, when a man died, his favorite wife was slain so she could share his future paradise. There appears to have been stiff competition among the several consorts, for in one man's tomb two wives were found with sacrifical blades in their chests.

At the time of the Trojan War, about 1200 B.C., the Thracians were held in high esteem. In Homer's *Iliad,* written some 500 years later, he listed many tribes coming to aid the embattled Trojans, but he was clearly most impressed by the Thracians, led by their noble King Rhesus. "His are the finest horses I ever saw," reported a Trojan scout, ". . . whiter than snow . . . the armor is golden and gigantic, a wonder to look on." Good King Rhesus was promptly slain in his sleep, and the sneaky Odysseus stole from him what was most worth grabbing: his dazzling white horses.

After the Trojan War, Thrace had a preview of things to come. Odysseus, sailing home with his 12 ships, raided the Thracian seacoast, killed many men and enslaved their wives. But during this same attack, Odysseus dealt more mercifully with a priest-king, who in return gave him gold, silver and 12 jars of strong wine. The wine turned out to be a godsend in Sicily, where Odysseus used it to make the one-eyed Cyclops dead drunk. Otherwise, this man-eating monster would have gobbled up Odysseus and all his crew.

All these events, however apocryphal, suggested that Greece was starting to discover that Thrace was a useful place to colonize—for its horses, gold, slaves and powerful wine, and access to other rich lands.

Tom Prideaux, who writes frequently for this magazine, described the treasures found in Tutankhamun's tomb in November 1976 issue.

Mysterious triple vessel dates from 13th to 12th centuries B.C. Electrum tubes connect the "spoons," allowing liquids to flow from one to another. Its use is not known, but was probably ritualistic.

Before the Trojan War, the goldsmiths of Thrace were already producing masterpieces. One small collection, buried in the palace ruins of a chieftain and dated between the 13th and 12th centuries B.C., ranks now as the most important find of Thracian gold ever to come to light; it clinched the high quality of Thracian handiwork. The most puzzling item was a "triple vessel" attached to a tridentlike handle (above). The three shallow spoonlike vessels, side by side, are connected internally by electrum tubes, which conveyed liquid from one vessel into the other two. Nobody knows why. One may conjecture that each vessel was filled with a different liquid which mingled with the others in a ritual, symbolizing perhaps an alliance of tribes or gods.

In the seventh century B.C., the Greeks began to conquer Thracian settlements on the Aegean coast, and the earlier incursions of Odysseus were succeeded by outright colonization. The Thracians struck back, as evinced by the rubble of their villages, which were rebuilt and razed several times. But they were too scattered to muster enough collective clout.

Archaeological Museum, Plovdiv

Silver gilt plaque from the mid-fifth century B.C., one of a pair, shows winged goddess of victory, Nike, in a four-horse chariot. She holds a wreath in one hand, while the other controls the reins.

Yet colonization had its advantages. For one thing, Thrace found a place in written history, trading its independence, so to speak, for immortality. Herodotus put on record: "The Thracians are the most numerous people in the world, except, of course, the Indians; and if they had one head, or were agreed among themselves . . . they would very far surpass all other nations. But such union is impossible for them, and there are no means of ever bringing it about."

Thracian girls, we are told, were sexually footloose but, once married, they joined their husband's stable of wives and settled down to housework and farming. No more skylarking allowed. Farm work, for men, was degrading, so they busied themselves with warfare, and proved their status by being properly tattooed. With an odd sort of practicality, the Thracians sometimes sold their children as slaves, who often turned up as smart-alecky characters in Greek comedies, sassing a master or seducing his offspring. The Thracians did not humble themselves easily.

Some tribes that believed in winning by intimidation vented their anger at thunder and lightning by shooting arrows in the air. Thus they warned their god Salmoxis to shut up and stop making such a ruckus in the sky. In another man-to-god deal, they decided to send a messenger to Salmoxis every five years with a list of requests. Chosen by lot, the messenger was swung by his hands and feet, and let fly onto upraised spears held by several people. If the messenger was fatally pierced, they assumed that Salmoxis was in a good mood and would grant their wishes. If the man was merely wounded, they berated him for being a wicked fellow, and chose another victim.

Greek and Persian influences

For a period of about 250 years, ending in 280 B.C., Thrace was at its cultural height. Along the coast the invading Greeks built temples, forts, theaters and fine houses. Rich Thracians developed a taste for Greek luxuries. Trading flourished. Local craftsmen picked up Greek styles, while Greek craftsmen on the scene gave their work an extra zing to delight their new customers. Greek coins were circulated, and the Thracians learned enough Greek to write a few useful words and phrases.

Another boost for Thracian art came in 512 B.C. when the Persian king, Darius I, led troops across Asia Minor and invaded Thrace on his way to Scythia. For 30 years the Persians occupied parts of Thrace, adding their influence to the local art. The extent of this influence is hotly debated, and even denied, by some archaeologists. But there does appear to be a whiff of Persia, for example, in the appearance of fantastic animal forms and in stylized face and body muscles. It is

Museum of History, Lom

Silver fibula (a clasp or brooch), fourth century B.C., is decorated with stylized animal heads.

notable, too, that a figure of Hercules, who in Greek art was traditionally depicted nude, is now clothed, as was the custom in Persia. That Thracian master craftsmen may have worked from Persian models is suggested by several objects from a wonderful haul of treasure, still being unearthed from some 50 mounds near the village of Douvanli. A silver rhyton (drinking vessel) that incorporates the head and foreparts of a galloping horse has a curvaceous elegance that hints at Eastern influence (pp. 42-43); and on a superb silver and gilt amphora, lotus blossoms (alternating with palmettes) in a border design appear to have been transplanted from Asia Minor, or possibly from the Upper Nile. There is no proof that such influences came directly, or even roundabout, from either place, but the presence of Persia seems unmistakable.

The Thracian ability to blend various forms is stunningly illustrated in a gold and silver greave, or shin guard, which culminates at the upper part, or knee, in a woman's head. The locks of hair falling on her shoulders terminate in lions, under which two snakes with lions' heads emerge from snail shells. Adding to this fantastic zoo are two more serpents with griffins' heads, and on the lower parts of the greave are spirals that merge into birds' wings.

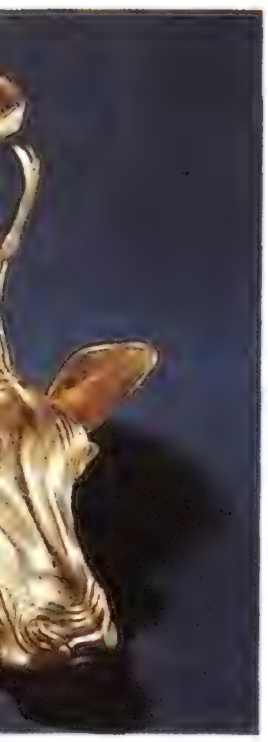
To most observers, the hit of the Thracian exhibit is the astonishing Panagyurishté treasure (pp. 48-49), named after a town near Plovdiv. Comprising nine gold vessels of diverse shapes, it is a lavishly decorated find, swarming with legendary figures—Dionysis, Aphrodite, Hercules, Theseus, along with centaurs, bulls, nymphs and sphinxes. Fashioned by craftsmen on the Asiatic shores of the Dardanelles, and dated at

Text continued on p. 50

All: Archaeological Museum, Plovdiv

The Panagyurishté Treasure

This show-stopping collection was discovered in 1949 in central Bulgaria by some workmen who were digging clay for bricks. It consisted of nine gold vessels, of which six are shown here. Immediately above is a phiale, or libation bowl, the exterior of which is decorated with three rows of Negroes' heads and one of acorns (detail at right). At the bottom of the page, from the left: a centaur, detail from the handle of an amphora; a rhyton in the form of a woman's head; a stag's-head rhyton; a goat rhyton; and another woman's head. The treasure was apparently buried for its protection during disturbances in the third century B.C.



the turn of the fourth and third centuries B.C., it is virtually a fanfare for the new and more baroque Hellenistic art, heralding a period of intense naturalism and unchecked emotion.

Up to a point, Thrace was able to coexist with its conquerors and colonizers. While the great Greek general Xenophon stopped off in Thrace on a march home from Asia Minor, a local king, Seuthes II, asked to borrow some of his troops to put down hostile forces in his own backyard. When Xenophon obliged, Seuthes II threw a banquet where he tossed hunks of bread and meat to his guests while plying them with strong wine. After downing most of the wine, the guests were bid to splash the last drops on themselves, thus becoming wine-soaked both inside and out.

On this mixture of boisterous behavior, canny opportunism and no little courage, Thracians had survived for centuries. But now circumstances were piling up against them. Their military and economic resources had been exhausted by a series of clashes with the troops of Alexander the Great (one of his generals ruled Thrace successfully for a few years), with neighboring Macedonians and Scythians, and with an influx of Celts who subjugated Thrace for 60 years. These setbacks were reflected in burial mounds, where dwindling local treasures gave place to big Celtic swords and new styles of harness from Central Europe.

But a new life began for Thrace when the Romans under Augustus swept in during the first century A.D. Once again, the invaders built new cities, opened new markets and added their own specialty, which was crisscrossing the land with roads. Gradually, the new prosperity was reflected in tomb treasure which regained most of its former splendor. Masks, helmets, body armor and heaps of chariot ornaments (opposite) were preserved. Fifty chariots were dug up with dead horses attached. The Romans, like the Greeks, found Thracians useful as soldiers, slaves and especially as gladiators. Probably the single best known Thracian today, thanks to a Hollywood movie, a popular novel and a spectacular production by the Bolshoi Ballet, is the fictional Spartacus, the heroic gladiator who led a revolt against his oppressors. And probably the best known Thracian town today, though under a different name, is Istanbul, still guarding the Bosporus.

During the Roman reign, the Thracian artists portrayed most of the invaders' gods on votive tablets which were included in burial mounds. Not unexpectedly among a nation of riders, the gods were mounted on animals: Jupiter on a stag and Diana sidesaddle on a doe. But amid this assorted company, the Thracians themselves steadfastly paid homage to a mysterious god of their own, an anonymous deity known simply as Hero. In ancient Thrace, Hero turned up in various places and shrines, waving a spear, holding a vessel, sometimes wearing an old warrior's hood. He was a link, then, to a very distant past and a very distant future. Acquiring a halo overhead and a monster underfoot, one of his descendants still rides in Bulgaria as the Christian St. George slaying the dragon.

District Museum of History, Rousse

Cult of Dionysus is celebrated on this richly decorated silver pitcher, early fourth century B.C.

Silver and gilt head of Hercules, with lion skin on shoulder, is a chariot ornament from Roman period.

Archaeological Museum, Sofia

Information: there's growing agreement

Human history has long been described in terms of Ages whose names reflect the stages of development through which mankind has passed: the Stone Age, the Bronze Age, the Iron Age and so on—down to the Industrial Age, which established the foundations of our modern society.

Today, there is growing agreement that we have entered a new era, a post-industrial stage of development in which the ability to put information to use has become critical, not only to the essential production of goods, but to efforts to provide a better life for the individual, as well.

This new era is being referred to with increasing frequency as the Information Age.

Information in the Information Age

Changes in our perception of information itself—its nature as well as its scope—have accompanied this profound shift of emphasis in our society.

Much has been written about the so-called "information explosion." It has been pointed out, for example, that the number of technical journals published throughout the world today exceeds 100,000, and that the total body of technical information is now doubling every ten years.

At the same time as the volume of information has been increasing dramatically, our understanding of the meaning of the term information itself has also broadened—to encompass a wide variety of timely data relating to "how things really are" across the whole spectrum of human activity.

A heartbeat, for example, can be extremely meaningful information when recorded and analyzed on sophisticated electrocardiogram equipment. So can electrical impulses reflecting the load level in a power network, or numeric digits representing the availability of a seat for you on an airplane—when processed by a modern computer.

These and a wide range of similar types of data are clearly recognized today as information, the kind of information on which we increasingly de-

that it's the name of the age we live in.

pend for the growth and health of our economy, the smooth functioning of our institutions—and, even more important, for the quality of our individual lives.

Information—an inexhaustible resource

Information is one of the few resources not in danger of exhaustion on this shrinking planet. It is unique because the supply is limitless, because it actually becomes more valuable with use and because—when properly managed and applied—it can greatly enhance our use of all our other resources, natural, human and economic.

One reason, of course, that information has proved to be such a dynamic resource is the fact that there exists today a remarkable technological capacity for dealing with it rapidly and effectively.

Through a vast array of electronic tools and techniques, mankind is able to accumulate, organize, store, interpret, retrieve and transmit information on a worldwide scale, in a volume, at a speed, and with an accuracy that would have been impossible barely two decades ago.

It is also a technology that continues to grow and that has proved to be amazingly efficient in economic terms. As advance has followed advance, the cost of processing information has steadily declined. Since the 1950's, the cost of performing 100,000 calculations on an IBM computer has fallen from $1.26 to less than one cent—and the downward trend continues.

Putting information to work for people

IBM makes many different products—from computers to copiers—but clearly, the essence of our business is information.

As a company, we are committed to exploring the limits of technology to find better, more imaginative and more productive ways to help put the benefits of this uniquely valuable resource to work for people.

IBM

Plasmid DNA drips from a glass rod into flask. This genetic raw material is split by restriction enzyme and joined to donor genes by another enzyme (p. 56). Result is a hybrid molecule with new genetic material.

By Janet L. Hopson

Recombinant lab for DNA and my 95 days in it

Despite the hue and cry over 'creating life,' researchers insist that their scientific gene-transplant experiments must go on

Author Janet L. Hopson, science writer and editor, amid apparatus of California gene laboratory.

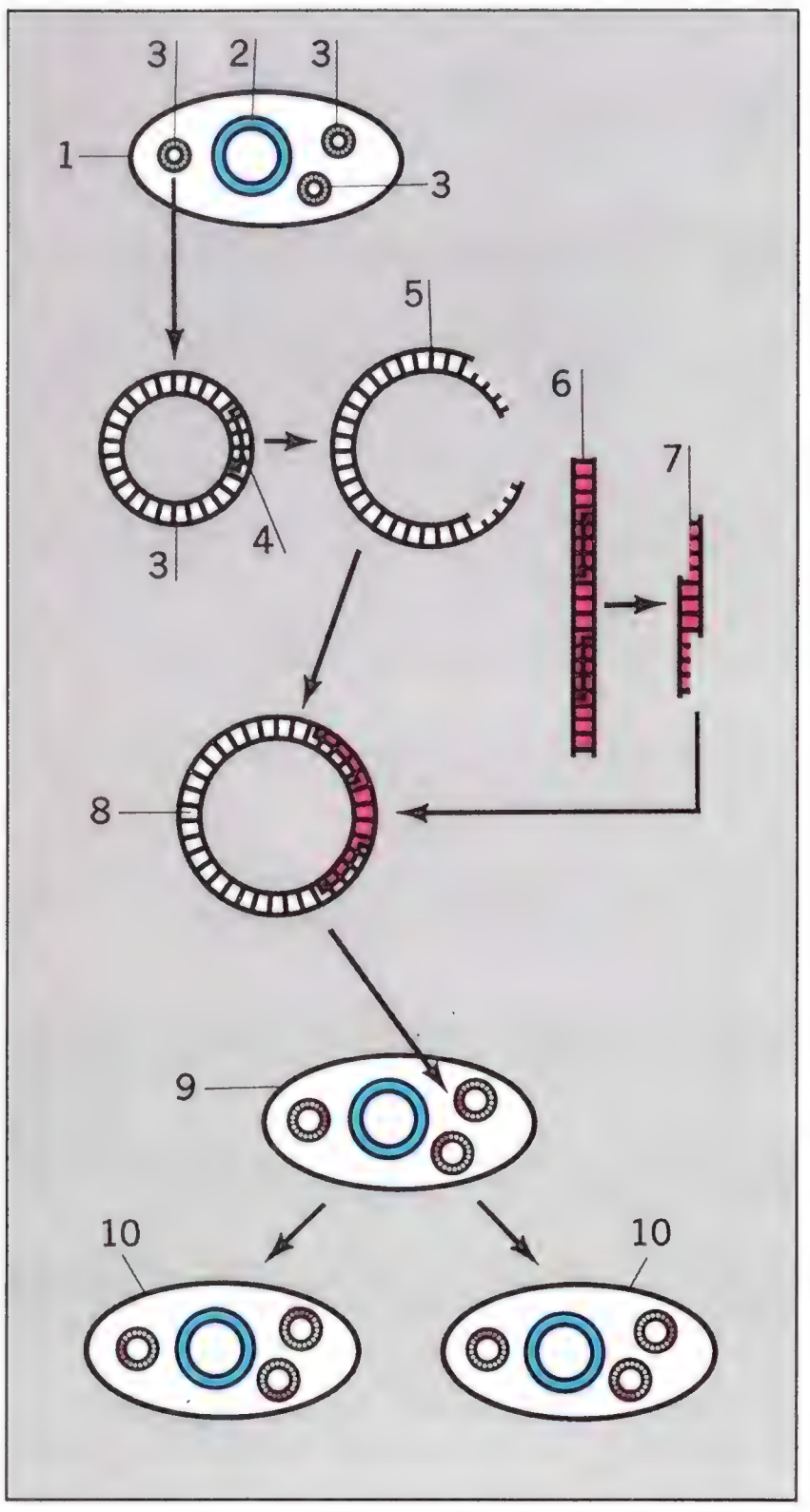
Last September I left my job as a science writer in the nation's capital to become, for three months, an unqualified but thoroughly spellbound drop-in genetic engineer. My interest had begun in 1974 during a press conference announcing what has since become the hottest science story of the Seventies. On a sultry July afternoon in Washington, three nervous biologists told the press that they had just drafted an open letter to the world scientific community, asking for a moratorium on certain gene transplantation experiments. Scientists could now transfer pieces of DNA from one creature to another, a technology with extraordinary potential for medicine, genetics and agriculture and also for germ warfare and environmental disruption. If a foreign gene could be implanted some day to cure a congenital disease or create a corn plant able to fix its own nitrogen, perhaps a gene for botulism or cancer could be implanted as well.

But basic research can't simply be called off at the drop of a test tube, so a blue-ribbon panel labored for months to write stringent guidelines that would make such experimentation safer. Nevertheless, the regulations issued by the National Institutes of Health in June 1976 alarmed some citizens' groups, who thought the rules weren't tough enough. Since then, the controversy has been bruited in the press, anguished over in professional meetings, debated in both houses of Congress and discussed on countless TV panels. The mayor of Cambridge, Massachusetts, worried publicly about what sort of monster might crawl out of a recombinant DNA lab; Biochemist Erwin Chargaff declared: "the future will curse us" if we continue to "engage . . . in a destructive colonial warfare against nature."

On the positive side, the new technique may lead to cheap, plentiful synthetic insulin, vitamins, growth hormones, and a clotting factor for hemophiliacs, to new varieties of crops and eventually even to assembly-line production of vegetable and animal proteins that simulate nature's own, but at far lower cost and without the saturated fats.

What sort of person, in what kind of Strangelovian laboratory, spends his time making genetic chimeras? What do these halfbreeds look like? What, for that matter, does DNA look like, this deoxyribonucleic acid, this minute part of the cell that transmits the hereditary characteristics of the individual organism

Color photographs by Christopher Springmann



How old life forms are transformed into new ones: Natural *E. coli* cell (1), with chromosome (2) and gene-bearing plasmids (3s). Plasmid is mortise-cut (4) by enzyme, and opens (5), permitting insertion of alien DNA (7) from another plant or animal species (6). Dumped into cold soup of normal *E. coli* and calcium chloride, chimeric plasmid (8) is absorbed by bacteria as solution is warmed. The resulting hybrid cell (9) breeds true, and can replicate (10) normally.

and determines whether it will become fish or fowl, man or monkey? And just how safe are the remarkable new techniques? With the help of a special research grant from the Council for the Advancement of Science Writing and the National Institutes of Health, I got my answers firsthand. The following are excerpts from the journal I kept during my 95 days in the van of contemporary science.

First Day: I arrived late at Dr. Herbert Boyer's office in San Francisco. I panicked, figuring I'd disrupted his morning schedule. I knew Boyer by reputation as a microbiologist who had published dozens of papers, and played a major part in founding the strange new discipline of gene transplantation. He'd done important early work with the enzymes now widely used to cut and paste DNA into recombinant molecules. Yet he had been one of 11 luminaries who signed the now-famous letter requesting that certain recombination experiments be stopped.

With all this in mind, I expected to meet a distinguished man in his middle fifties, irritated by my tardiness, and as stiff and colorless as a lab report. But the fellow who opened the door was wearing gym shorts and munching an apple. Boyer's curly hair and mustache were still damp from jogging and showering. He looked to be about 35, was tanned and talked easily between bites of the apple, blending phrases like "EcoRI endonuclease recognition sequence" and "Wow! That's far out!" in the same sentence.

An entire wall of his small office was stacked with books and back issues of scientific journals. Another wall was covered with newspaper clippings and environmental posters. Several changes of clothing hung from a hook on the door, and a dead fern sat on the window sill. A pile of books—Hermann Hesse, Tom Robbins, Krishnamurti, Fritz Perls, Gail Sheehy—had slumped over on the couch like dominoes. Boyer had just turned 40, he said, had lost weight, was reading Gestalt psychology and learning to relax. The phone on his desk rang, summoning him to a departmental meeting. We'd talk later about the experiment I would soon begin.

Second Day: I grabbed an early bus and was the first

At National Academy of Sciences in Washington in March, protesters linked genetic engineering to Nazis.

Foes of DNA experiments wave posters at the NAS forum, reject assurances techniques are safe or wise.

one into the lab. Boyer's laboratory is not a single room but a half-dozen, stretched along both sides of a pastel green corridor on the fourth level of the University of California's medical school in San Francisco. It might pass for the original Ivory Tower—gleaming white and standing side by side with a handful of other medical buildings near the summit of Mount Sutro. The lab's north-facing windows offer a magnificent view: the stucco and frame town houses of the city's west end, stretching in two directions toward the sea; the rust-red towers of the Golden Gate Bridge behind the greensward of the Presidio; and beyond, breakers smashing against the rocky headlands of Marin County. A workshop fit for Olympians.

Inside, however, where the labor goes on, the environs are decidedly pedestrian. None of the six enclosures is larger than a bedroom, yet each is packed with an incredible array of benches, cabinets, sinks, refrigerators, large and small electronic instruments, batches of chemicals and glassware. Every desk and countertop is littered with papers, books, pads and numbered bottles. Every vertical surface is covered with paper: family photographs, posters, cartoons, intricate chromosome maps, telephone numbers, words of wisdom and whimsy.

I recalled an article on recombinant DNA research with some admonitory headline about "Frankenstein tinkering." Yet nothing here seemed particularly malign—no dark corners or sparking generators. The tiny vials of enzymes and DNA stored in the refrigerator racks looked harmless enough. And there were definitely no monstrous hybrids or fearsome animals of any kind—excepting one small black mouse sitting in a wire cage.

Third Day: I met the rest of the staff. All 11 were assembled for the weekly lab meeting. We sat in comfortable chairs in a conference room on the ninth floor while Bob Tait described his latest work with antibiotic-resistant plasmids. Bob is a 25-year-old PhD candidate, a slight, bearded man who often wears cowboy boots and an orange T-shirt tucked into brown Levi's. His clothes and beard are typical of the male staff.

Besides Herbert Boyer and Bob, the group included two technicians, three graduate students and four postdoctoral researchers who came to this business from a variety of backgrounds. One, for example, is the son of a prominent scientist; another, the son of a migrant farm family. Two came from Mexico City, one from the Netherlands. All proceedings were highly democratic. Specific knowledge outranked degrees, and the youngest was free to challenge even the most senior as long as he or she could add a piece to the molecular puzzle.

Tenth Day: The day ended with a celebration of Paco Bolivar's successful plasmid. The common currency in this lab is deoxyribonucleic acid or DNA, the forms it takes, such as the ringlike plasmids, and the cells that carry it, such as the bacterium XI488. Over the last two decades, biologists have discovered that plasmids carry genes and thus can direct the production of proteins and enzymes, just as the cell's chromosomes do. They also have discovered that this genetic "loose change" can be transferred from one cell to another, and once inside a host cell will continue to direct

In a genetic workshop

The mad pace and clutter of Boyer lab contrasts sharply with the precision and intellectual

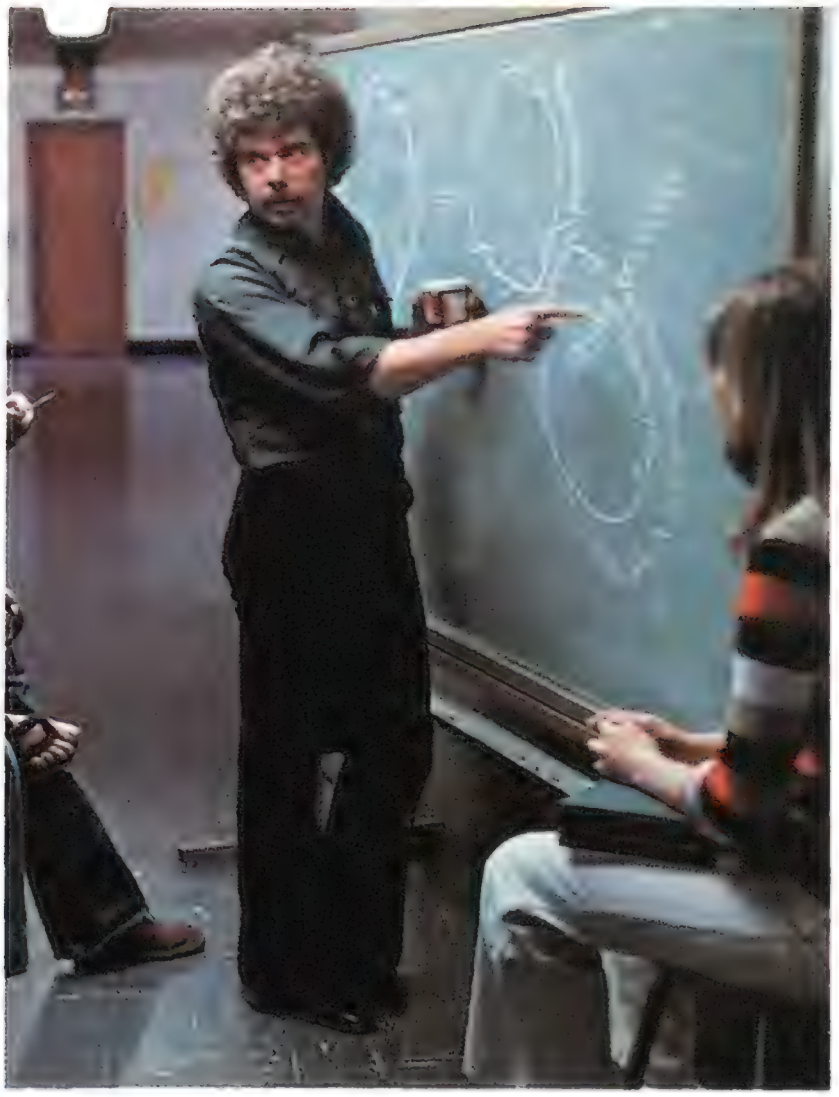
the production of the molecules inscribed in its own chemical code. In the early 1970s, Boyer and other researchers showed that certain enzymes can cut DNA precisely at certain points along the twisted molecule. Those enzymes now allow researchers to excise a gene from one organism and transfer it into a new cell, using plasmids as the natural vehicles.

The technology has begun to mushroom in the past few years. Dozens of "restriction" enzymes are now employed in labs all over the world to remove and insert genes. And although some scientists have plans to insert foreign genes into tissue cultures of animal cells, bacteria have played host, thus far, to most recombinant molecules. At this point, then, much of the new technology depends on the availability of restriction enzymes and the suitability of specific plasmids for transporting genetic messages. Hence the urgent construction of plasmids in Boyer's lab.

Paco, a tall, thin Mexican with sandy brown hair and beard, had been trying for several weeks to construct the world's smallest known plasmid by chemically stitching together tiny fragments of DNA. Today he came whooping down the hall, holding a small photograph, the visual confirmation that he had succeeded. The photograph was not of the plasmid itself, which is far too small to be seen except under any but the most powerful electron microscope, but of a tiny white band on a dark field. It brought backslapping and handshakes from the others and sent Paco running out for champagne and paper cups. When he returned there were enthusiastic toasts like "To a new era of plasmid construction!" and "Let's make a superior grape!" And then Boyer rushed Paco off to talk about his discovery and plan the next steps.

Seventeenth Day: Even now that I've begun to understand the routines, the lab seems in a perpetual frenzy. Work begins at 8:30 sharp and doesn't end until 6:30 or 7 P.M. Carrying flasks and test tubes, people run between rooms like Keystone cops, their movements orchestrated by the jackhammer sound of timer bells, the dull flapping of dialyzers and the hissing of autoclaves. There are periodic shouts of ecstasy and dismay.

I've learned to identify most pieces of equipment and how to operate them, and today I started "my" experiment. Ray Rodriguez, the handsome, black-haired postdoctoral researcher named as my teacher and coach, found me at my station, a stool near the coffee pot where I could chat with people but stay safely out of the fast traffic lane. He drew some diagrams in a small, bound memo book and explained the object of the experiment. It seems that one laboratory strain of the intestinal bacterium *Escherichia coli* (*E. coli* for short) contains a large plasmid with a set of genes that direct production of a restriction enzyme called EcoRII. Inside the cell, the enzyme helps protect the organism from viral attack by chopping up the intruder's DNA. Outside the cell, when harvested in large quantities, the EcoRII enzyme helps researchers



Microbiologist Herbert Boyer leads brainstorming session where staff lofts some of its wilder ideas.

rigor of the historic experiments conducted there. As in science generally, most experiments fail.

cut DNA strands for their recombination experiments.

Our goal is to find and remove the EcoRII genes from their natural, slowly reproducing plasmid and insert them into a more prolific plasmid, so more EcoRII enzyme can be gathered from fewer cells. The first step in the experiment is growing cells, and that began with a visit to Mary Betlach, the "cell dispenser" for the lab. In a locked wooden cabinet over her desk, she keeps a dozen test tube racks filled with wax-sealed tubes. Inside of each, on top of a teaspoonful of amber-colored translucent gel, grows one strain or another of bacteria in sticky white colonies.

Many of the colonies had been growing there for more than two years and would go on living, Mary said, as long as nutrients remained in the agar. She opened a tube marked "RY22," and sterilized a slender wire loop. She touched the bacterial colony to pick up cells, then flicked the loop across the surface of an agar plate. Then she strode down the hall, brown hair flying behind her, to put the plate into an incubator. There, sitting on a mountain of food, the cells would multiply rapidly.

Dr. Boyer, 40, jogs two miles a day through Golden Gate Park, climbs nearby mountains to keep fit.

In a genetic workshop

Under ultraviolet light, plasmid DNA in agarose gel will show on surface as lighter pink spots.

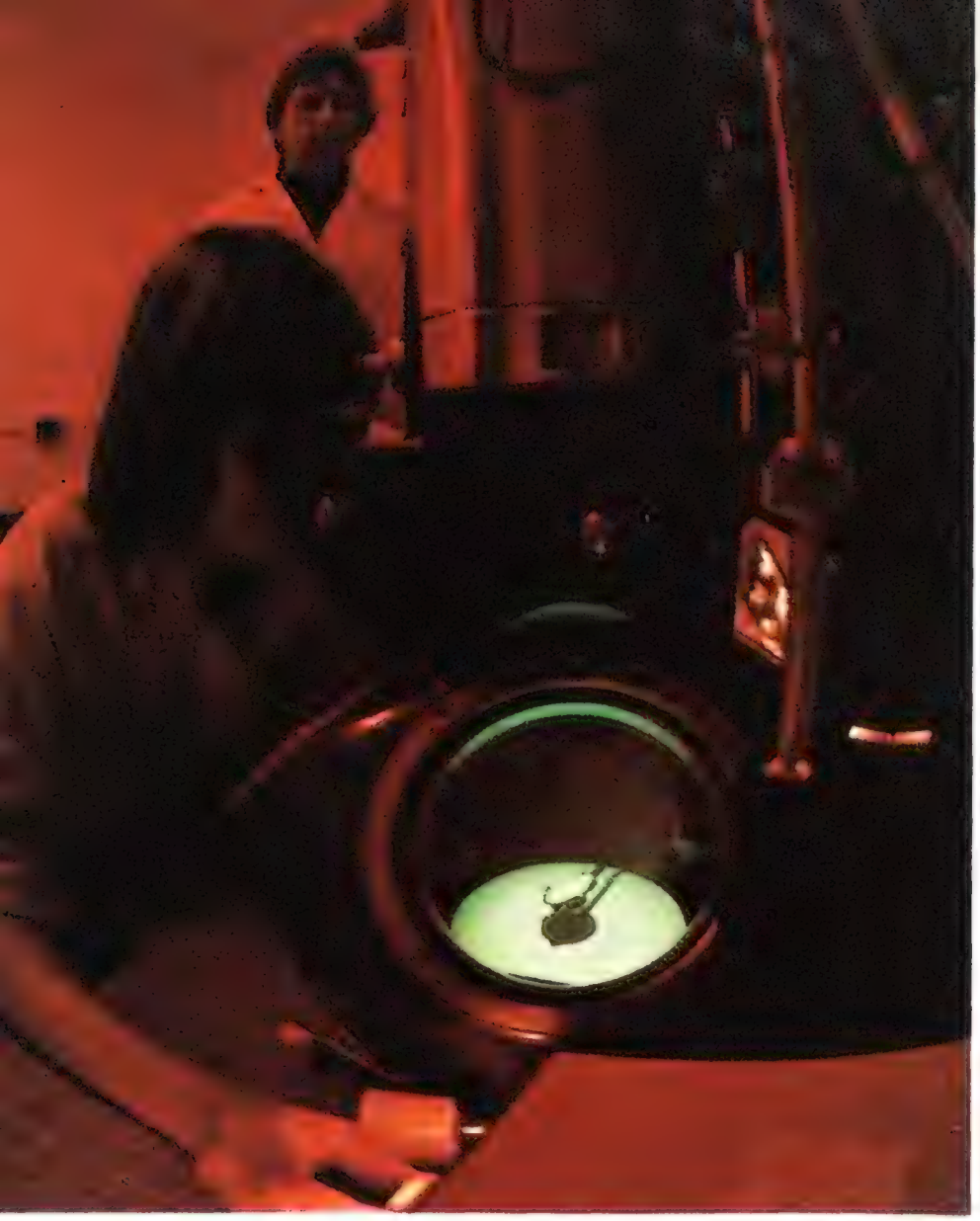
Meanwhile, I prepared several large flasks of liquid growth medium to enable us to work with four full liters, rather than one small dish, of RY22 cells. The growth medium is called Brain-Heart Infusion—a liquid that smells just like the slaughterhouse that provided the calf brains and beef hearts in the first place. Later in the day, after Ray returned from a pumpkin hunt with his three-year-old daughter, we inoculated each flask of sterilized broth with the RY22 bacteria. Each teaspoonful of inoculum contained more than 200,000 cells, yet they disappeared into the yellowish broth without a trace. By morning, however, each flask would be clouded with more than 50 billion cells and the original bacteria would have gone through 18 generations—an era that would end abruptly as we chemically exploded the cells to release their plasmids.

Thirtieth Day: "Have you seen DNA yet?" Herb Heyneker asked me this morning. He reached into a black foam bucket filled with ice and brought out a shiny, wet test tube. Held up to the light, the tube revealed a nearly transparent glob laced with tiny shimmering bubbles and trailing streamers into the clear surrounding fluid. The streamers coiled downward, clearly suggesting the famous double helix. But no—they were visible evidence, Herb told me, of the simultaneous twisting of countless strands of DNA molecules, collected from several billion *E. coli* cells, each containing many plasmids. This minute accumulation, a quarter of a teaspoon, now contained quadrillions of plasmid DNA molecules. When I looked up, Herb was laughing at my dumfounded expression. "But you can actually *see* the DNA!" I said. "That's nothing special," Herb replied. I was still impressed.

Forty-fifth Day: Today I mentioned over hamburgers in the cafeteria that I'd seen yet another newspaper story on the growing public concern about recombinant DNA research. Many people, both scientists and laymen, seemed dissatisfied with the first guidelines issued by the National Institutes of Health. And those concerns were turning into action. The city council of Cambridge, Massachusetts, had suspended recombinant work in that city and organized a study team of local citizens. The state legislatures in California and New York were considering bills to take control of all such experiments, both academic and industrial. Similar bills had been introduced in both houses of Congress.

Most of those at the lunch table disagreed strongly with these efforts. "The work is totally harmless," one said, "and controls are holding up vital research. We have enough growth hormone genes upstairs right now to clone for a year, but with the guidelines, we can't do a thing." Another added, "It's ridiculous, because other researchers right here are doing dangerous studies—like infecting human tissue with monkey viruses—without any special containment. But we can't even use human tissue in our work without expensive containment equipment and special organisms that aren't even available yet."

A third person claimed that the fear of producing organisms that can't be controlled was absurd. "The bacteria we use [a strain called *E. coli K-12*] are peren-



Electron microscope, magnifying tiny recombinant molecule, verifies the success of an experiment.

E. coli cells with man-made plasmid, reproduce (blue clumps). Amber colonies are ordinary cells.

nially sick and live only briefly outside the test tube." He urged the first person to go ahead with his growth hormone studies anyway. "We're not from the U.S." he said. "No one has to know if you go ahead a little early. You can repeat the experiments later and publish them from your own country." This suggestion was considered and politely declined.

Some leading biologists have argued that peer pressure would serve as an effective control over dangerous experiments. But these leaders do relatively few experiments themselves. Boyer, for example, seemed to spend most of his time writing lectures, applying for funds, attending departmental meetings, conferring with students and traveling. The attitudes of laboratory chiefs may well be quite different from those of lab workers who want to do significant experiments but must follow guidelines they did not draw up.

Fifty-second Day: After last week's luncheon I brushed up on the NIH guidelines and watched day-to-day lab procedure more closely. Since most of the experiments here involve the transfer of genes between different strains of the same organism, *E. coli*, the lab is classified P1, which requires no special equipment or organisms, but does demand good microbiological technique. The workers rarely wear white laboratory coats (suggested by the guidelines) and they smoke, eat and drink in the lab while experiments are in progress (expressly discouraged).

I also watched people sucking recombinant organisms into glass pipettes with their mouths instead of the recommended rubber bulbs, and saw work surfaces decontaminated only sporadically—instead of daily, as required. Half of the researchers here follow the guidelines fastidiously; others seem to care little.

One PhD candidate visited from another university this week and did experiments with a disease-causing bacterial strain. These experiments would seem to require a higher level of physical containment than our P1 lab affords—probably a costly type of ventilation hood. When asked what level was specified by the guidelines, he replied, "Damned if I know." Someone else asked, "Well, what containment level do you use at your own lab?" He shrugged, "I never looked it up." When I talked about this cavalier attitude with Ray, he reminded me that there have been no accidents with recombinant organisms to date, either here or elsewhere, and that if anyone is at risk it is themselves.

Sixty-fifth Day: Our experiment turns out to be a lot harder than I thought, and visually more interesting than I expected. Two steps among the two dozen

required to collect plasmid DNA actually bring that molecule (or at least its shadow) into view. These steps demand scientific judgment, careful timing and dexterity. As Ray's apprentice, I do the easy parts.

Seventy-first Day: The high containment (P3) lab upstairs was shut down by the university's biohazard committee for a few days this week. I was dismayed to hear people joking about the closure and the messy conditions that precipitated it. Among the young graduate students and postdoctorates it seemed almost chic not to know the NIH rules.

Eightieth Day: Our attempts to transplant the EcoRII genes move forward haltingly. I'm growing more cells today, and we'll soon begin again the process of harvesting RY22 plasmid DNA. We discovered recently that our last batch had been contaminated somewhere in the long process. The RY22 bacterial plasmids are both rare and fragile; their desirable genes have never been successfully transferred.

Ninetieth Day: A science reporter from Washington had received what he thought to be inside information on the first biohazard accident in a recombinant DNA lab; he was eager to break the story and had called Boyer in hopes of confirmation. Rumor had it that a bacterial virus which couldn't be killed—a true Andromeda strain—had been created by accident at the San Francisco laboratory. The real story, Boyer assured him, was not so exciting: a sloppy technician had spilled some growth medium contaminated with ordinary bacterial virus and had failed to clean it up properly. "No, that's not true," I heard Boyer insist. "It didn't happen that way at all. You're not listening . . . look, I'm very busy and we're just wasting time by arguing." When he hung up, Boyer shook his head and brought out a stack of letters from people who had written to voice opposition to recombinant DNA research. "Hate mail," he called it.

The idea that observers from the community or their legislative representatives could assert control over daily laboratory routine seems foreign to the sober, scholarly people who study bacterial genes. A revolution in the relationship between science and society is already well under way, yet attitudes and safety procedures, at least for some workers, still lag behind their new public accountability.

Ninety-fifth Day: My internship ends today. After 12 weeks of labor, I have a dog-eared notebook peppered with the phrase "results negative," and detailed knowledge of procedures to avoid next time. The people here assure me that quick positive results are rare, and that experimentation means trial and error, with the emphasis on error. I wondered, leafing through page after page of data, who first came up with the notion that any day now some bright high school kid may build a monster in his basement. Evolution seems to have built into even the simplest bacterium considerable resistance to outside tampering.

Boyer seemed unperturbed by our lack of progress, a composure I've come to view as characteristic. As I left the lab for the last time, he was fortifying himself with Brie and paté for a footrace up some mountain that evening. We shook hands by the door. He raised a piece of rye bread in a toast and grinned: "To RY22."

Red light traces outline of new DNA plasmid while a computer figures and records its true length.

E. coli cells were dissolved and centrifuged to separate chromosome from plasmids. Drop has trillions of plasmids.

"Holmes, where have all the Ford and Chevy owners gone?"

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By Maureen Green

Always something to do at Britain's National Theatre

After ten years and many misgivings, London's great new drama complex is now going at full blast—and almost SRO

A Swiss visitor to London in 1599 wrote in his diary that after lunch one day, "I and my party crossed the river, and there in the house with the thatched roof we saw an excellent performance of the tragedy of the first Emperor *Julius Caesar*." The play is still running, as any visitor to London this year can witness, with Shakespeare's world conqueror definitively performed by Sir John Gielgud. But the players and audience are now enjoying something better than thatch. On the south bank of the Thames, one bridge away from the original Elizabethan Globe, rises the National Theatre's new steel, glass and concrete citadel, its terraces overlooking a panorama stretching from Big Ben to St. Paul's, its nine plum-carpeted bars stuffed with publike chatter, its three theaters offering a rich variety of dramatic experience.

In the amphitheater of the Olivier, 1,160 theatergoers surround a stage which resounds to the mighty verse of Marlowe and Shakespeare; before the more traditional proscenium stage of the Lyttelton Theatre, 890 guffaw at the intellectual Ping-Pong of Tom Stoppard, plumb the mysteries of Harold Pinter or titter at the suburban idiocies of Alan Ayckbourn. And in the "studio" Cottesloe Theatre, a crowd of 400 young people can follow the nine-hour science-fiction epic *Illuminatus*, or get their first view of a new young dramatist. At long last, London has presented its renowned strolling players, its richly talented playwrights, with a home to call their own.

For the last ten years, Londoners have watched the gray concrete walls of the National Theatre building rising beside Waterloo Bridge as they hastened past to admire the starry National Theatre players—Olivier in *Othello*, Gielgud in *The Tempest*, Albert Finney in modern farce, Maggie Smith in Restoration comedy, Diana Rigg in Molière—in the cosy Victorian comfort of the Old Vic just down the Waterloo Road. True, the Old Vic was so small that it became impossible to get tickets; true, the wails from the nearby ambulance station could sometimes be heard as accompaniment to

Marlowe's *Tamburlaine* on the Olivier's circular stage: Denis Quilley and Barbara Jefford as

Tamburlaine's prisoner and his wife; Albert Finney in the title role; and Brian Cox, Oliver Cotton and Gawn Grainger as his henchmen. The spectacular production will return to the repertory this fall.

the voice of Sir Laurence Olivier in the quieter passages of *Long Day's Journey into Night*; there were even some seats behind pillars from which it was hard to see a thing. But if you could get in, you could put up with these imperfections, just as the actors put up with backstage squalor and rehearsals in nearby huts. Did anyone really need an expensive new building, which, in its quarter-finished state, resembled nothing so much as the Berlin Wall?

But now that the National Theatre is open and vitally in use, theatergoers have found it amazingly easy to adjust their expectations upward. There are few theaters in London where there is much point in arriving more than two minutes before the curtain goes up, or lingering at all after the play is over. The National Theatre, however, is open all day, its foyers offering exhibitions of drawings or photography, its bookstalls selling the London evening papers, texts of current productions and drama manuals, its intimate bars keeping traditional pub hours. From six o'clock,

Photographs by John Walsh

the foyer of the Lyttelton is bright with the music of guitar and lute, folk or madrigal singers, while young people sit on the floor and listen; actors in the company do "Extras," informal readings of poetry or short plays that particularly interest them, before the evening's real business begins. The restaurant opens well before and closes long after all the plays.

The whole interior avoids solemn grandeur, but achieves confident elegance. The audience looks and feels right in diamonds or denims. In the year since the first stage—the Lyttelton Theatre—opened, word has got around that there is always something to do at the National, apart from the plays.

Popular doubts were voiced mostly about the outside. Londoners do not like concrete, and the National Theatre's five-and-a-half acres of this austere material seemed as brutal as the final cost—£16 million. Sir Denys Lasdun, the 62-year-old architect, is not dismayed. "I don't mind its being called a fortress," he says. "I have buried the auditoria like tombs in a pyramid to protect them from London's noise." The monumental front, facing the river, has the scale and mood to make it already a real addition to London's cityscape, even if the way to appreciate its most attractive aspect would be to arrive by ceremonial barge. As it is, the public arrives by car or subway at the rear, near the theater workshops, which look much like a warehouse. Not everyone found it immediately obvious how to get in. At one point, a tall, thickly bespectacled figure was seen wandering outside the vast concrete walls, half bewildered, half amazed, looking for a way through to see the director; it was playwright Samuel Beckett. But the terraces, which some at first thought separated the theater too far from the river, are now seen to offer, as Lasdun predicted, "a fourth theater, with the backdrop of London beyond."

As soon as the unpredictable London weather al-

At dusk, the tiered and terraced National Theatre brightens up the south bank of the Thames. In the distance is the dome of St. Paul's Cathedral.

Every evening there are shows and concerts in the foyer before the regular performances. Here, a casual crowd listens to a woodwind group perform.

lows, crowds move outside to drink and talk in clusters; children fly kites or watch Punch and Judy shows; actors occasionally opt for an open-air rehearsal; and on Easter Saturday the medieval mystery play of The Passion of Our Lord reached the climax of the Crucifixion on a terrace among appropriately massed crowds of spectators.

For the director, Peter Hall, and the company of actors, directors and designers, the first year in their permanent home has been predictably stormy. They have been accused of failure (but of their 15 productions, 12 have been well received and only three have been panned by the critics); of being too successful, so that they monopolize attention; of putting on new sure-fire comedies that commercial managers might do; of putting on aggressive social attacks like young playwright Howard Brenton's *Weapons of Happiness*, that few others would dare to touch; and, above all, of extravagance, soaking up all available government subsidies while other theaters are facing hard times. At one absurd point, the gory production of Marlowe's *Tamburlaine the Great* was waspishly reported to have monopolized all of London's supplies of theatrical blood, until the N.T.'s workshops haughtily replied that they concocted their own.

The very idea of a National Theatre, after all, has aroused passions for more than 120 years. "Do we really want a National Theatre?" has been a question constantly asked, despite the fact that George Bernard Shaw answered it in 1937 by saying, in effect: "The British public never wants anything: they never wanted the British Museum or the National Gallery or Westminster Abbey, but now they are quite proud of them and feel the place would be incomplete without them." Over the years at least four sites have been proposed, and the foundation stone laid by the Queen Mother in 1951 has been moved three times, causing her to murmur, "What a pity it couldn't be on casters."

After Parliament finally voted the money and the Greater London Council provided the perfect site on the King's Reach of the Thames, it still needed all the crucial prestige and pressure that Sir Laurence—now Lord—Olivier could bring to bear to produce action. In 1963 he and the Building Committee, including the choicest and most vocal spirits of the British stage, selected Denys Lasdun from the many architects who sought the commission. As Lord Olivier now tells it, "We didn't want anyone who had designed a theater before, we wanted to find a new soul. Lasdun put his finger on it very cleverly. He said that surely the most important aspect of what we were talking about was

Maureen Green is a free-lance writer who lives in London. She wrote about restoration of Canterbury Cathedral's stained glass, SMITHSONIAN, *June 1975.*

Sir John Gielgud waits patiently as director John Schlesinger makes a point to the cast during rehearsals for *Julius Caesar.*

In the workshops, designer John Bury personally paints the wounds on a dummy that will stand in for Caesar's corpse.

Ann Firbank, who plays Caesar's wife, Calpurnia, has costume adjustments made in splendidly equipped wardrobe workroom.

the spiritual one. We all fell for that. He was a unanimous choice."

But there the unanimity ended. For two years the Building Committee met once a month with the architect to talk out, as Lasdun recalls, " 'What is the nature of a theater in the second half of the 20th century?' Oh, those awful meetings! The whole lot has been recorded and buried to be released to posterity after our deaths."

Various factions on the Building Committee felt that one revolutionary theater—the one named for Olivier himself—was not enough; so a second, more conventional, stage—the Lyttelton—was added (against Peter Hall's wishes); and then, allegedly to please director Peter Brook, a small "open space" or studio theater, the Cottesloe. And while in the affluent Sixties a policy of giving everyone everything that they had asked for seemed feasible, as the more austere Seventies arrived, as ill health forced Olivier to retire as director and Peter Hall took over, as fashions changed and small community theaters became the vogue, as directors like Jonathan Miller began to attack "the edifice complex," as cutting costs became a national priority, the monster building growing on the South Bank began to inspire terror rather than excitement. "Grotesque delays" on the building site, as Peter Hall complained, forced him again and again to postpone productions, release actors from their contracts and finally put on the "opening" production of his *Hamlet*, with Albert Finney, back in the Old Vic, since the theater for which it was designed was still unfinished. Hall fought his "last battle" in September 1975 and announced that he and the actors would move into the new building even if it wasn't finished, and play on stages as they became available.

In March 1976 he shifted six successful productions from the Old Vic into the completed Lyttelton (named after Oliver Lyttelton, the first chairman of the National Theatre Board). The cool, wide proscenium stage at once showed what its possibilities were; it could contract or expand its height and width, adapt to the claustrophobic first-act drawing room of Ibsen's *John Gabriel Borkman*, or expand for the last act to allow Sir Ralph Richardson to stagger off very movingly to death in the snows. "The acoustics are perfect, the sightlines are perfect; the actors feel like people introduced to a promised land," said Peter Hall. Best of all, actors in new plays could actually rehearse on stage, a luxury never achieved at the Old Vic. The Lyttelton stage is an elevator, surrounded at its sides and back with wagons, or trays, on which complete sets can be installed and slid forward in minimum time. A new John Osborne play was rehearsed with its sets all day, while the set for Noel Coward's *Blithe Spirit*, directed by Harold Pinter, stood ready for the evening, and the set of *Jumpers* ready for the evening after that. The repertory system could work efficiently, the actors were impressed, and the public packed the house. "My foot is in the door," announced Hall.

Six months later (October 1976), the Olivier Theatre, the heart of the entire building, opened with a production of Christopher Marlowe's *Tamburlaine the Great*, directed by Peter Hall. Marlowe's Renaissance blockbuster, though it lacks the psychological

Prunella Gee and Chris Langham in *Illuminatus,* a nine-hour experimental play based on the work of two American writers.

Judith Paris as Dorothy with a stuffed Snoopy dog and back-screen projection in the first act of Tom Stoppard's *Jumpers.*

insights of Shakespeare, is part of an early tradition of popular display, of an era when actors appealed in very direct terms to involve their audiences. On the circular drum stage of the Olivier, fanned by the concentrated attention of a thousand pairs of eyes, none of them more than 60 yards away, Albert Finney played the Scythian shepherd boy who makes for the Sultan's crown, appealing with ease to the populace: "And so would you, my masters, would you not?," then riding his chariot, drawn by captured kings, across the stage's vast spaces. Sumptuously costumed (and a prime target for accusations of extravagance), lit and set with barbaric splendor, *Tamburlaine* was the first indication of what the Olivier stage itself could do.

Sir Denys Lasdun made no secret of the source of his inspiration for the Olivier Theatre—the Greek amphitheater at Epidaurus. "You can go on and on about the scientific needs," he says, "no seating to be more than 60 yards from the stage, ad nauseam; if it only needed that, you could stuff it all into a computer. But people respond in certain ways to the feel of scale and space. The Greeks understood that."

In the Olivier, the actor and audience relate to each other in a crucial way. From the central revolving drum stage, with its numerous entrances from the rear, from central traps, from the flies and from two "vomitories" at the front, an actor can move onstage to address an arc of seating that surrounds him for 130 degrees, his visual span. The audience looks down onto the circle of light and action with a rare sense of all being close together, and in the same room as the actors. Where the audience is referred to as "the fourth wall" in the conventional proscenium stage theater, actors in the Olivier during rehearsals of *Tamburlaine* referred to the audience as the "fourth character."

Denis Quilley, one of the leading actors from Olivier's original company, says, "I couldn't wait to play Shakespeare on that stage. It fulfilled all my expectations. The front row is there three feet away from you, and the sides are in your peripheral vision. You feel you can command the whole house."

But Sir John Gielgud, one of the most experienced of all Shakespearean actors, who plays Julius Caesar (opposite) in this summer's production of the play, is skeptical. "After working for 50 years on stages where you know exactly what you are about, it's quite different at the Olivier," he says. "I am a little alarmed at the visual problem of masking other players, and I feel that some of the audience are bound to miss some bits of the play. Directors get excited by these changes, but the poor actors who have spent their lives learning how to dominate the proscenium stage, and how to put themselves across, are left feeling uncertain."

Bill Bryden, a director who bruised himself against Edward Albee's *Counting the Ways,* one of the first season's flops, more or less agrees: "The Olivier poses certain problems for actors. It's a stage on which actors can disappear if they are not charged with energy." Acoustics also are still being tinkered with, and not all the technological marvels are in working order yet, either; when finished, the revolving drum stage—40 feet in diameter—will split into two semicircles, either of which can act as an elevator and drop to the basement to receive a new set.

Britain's new National Theatre

For the current production of *Julius Caesar* in the Olivier Theatre, director John Schlesinger arrived hotfoot from his movie *Marathon Man* and announced, "I've never worked in a theater of this shape. I'm really fascinated by the depth and breadth of this extraordinary space. But I think the stage needs a kind of a lid on it." With John Bury, head of design, he came up with a vast inverted semicircular disk to front the stage and carry back-projections of travertine marble or close-ups of bloody battle.

David Hersey, lighting designer on *Caesar*, during a solid eight hours at a lighting control desk in the stalls, explained, "We are working out over a hundred lighting pictures, but I can recall any of them instantaneously with the computer for Schlesinger to have a second look. What we have done in the last few hours would have taken days to work out before."

Even so, lighting rehearsals seem interminable to the actors. Again and again, lighting was changed for the Capitol scene as Artemidorus approached Caesar and repeated, "Mine's a suit that touches Caesar nearer." "Mine's a bourbon," retorted the exquisite vibrato voice of 73-year-old Sir John Gielgud, as midnight approached.

By the spring of this year, the entire theatrical city had come to life. In the handsomely large spaces of Rehearsal Room One, Sir John Gielgud and a group of young actors half his age worked at the murder of Julius Caesar. In Rehearsal Room Three, Peter Hall began gently to feel his way into *Volpone* with his star Paul Scofield. Each night Maximilian Schell's vivid production of *Tales from the Vienna Woods* packed the Olivier Theatre. And in the Lyttelton, playwright Alan Ayckbourn's new work, *Bedroom Farce*, opened to rave notices. Then the third and final auditorium, the Cottesloe (named after Lord Cottesloe, a later chairman of the National Theatre Board) opened.

Tiny, immensely adaptable—its black-painted space can be filled with seating or stripped to provide an open center stage with balcony seating all round—the Cottesloe is what Peter Hall calls his "risk" theater. Risky in the extreme seemed the first offering, a fringe theater group from Liverpool mounting a nine-hour version of *Illuminatus* (p. 71), drawn from the science-fiction books of U.S. writers Robert Shea and Robert Anton Wilson.

Peter Hall's own many-sided talents bulk large in the success of the National Theatre. Not only is he a consummate politician, he is also, for instance, as one young actor in the company sighs, "the ultimate authority on verse speaking." He crackles with ideas, his grand design being to keep his drama city vital and avoid its ever becoming a "temple of culture." In the Olivier, he plans always to be finding new ways of renewing the classics; in the Lyttelton, modern comedies, perhaps 19th-century works, and visiting companies from abroad, to correct the insularity of the British—too ready, he thinks, to believe foreigners who tell them they have the best theater in the world.

Hall puffs on a cigar and explains, "I'm completely schizoid. I couldn't do the managing side if I didn't have a chance to direct, but I wouldn't want to direct without the involvement and control of managing." As it is, he has been doing both most of his life—as a young man founding and running the Royal Shakespeare Company at Stratford, and now, at 46, firmly in charge of the British theater's top job.

But now that he and his company are installed, he says, "The basic problem is this: we have three very fine theaters of different capacity, we have a chance to be daring, to take enormous risks. But this building is very expensive. It costs £5 million a year to run, half of which we can contribute from our takings, but the other half has to come from the government." With seat sales at over 90 percent of capacity, and advance bookings at an all-time high, Hall finds it easy to convince the powers-that-be that he is doing his share, less easy to get them to do theirs.

"Economically, this is the worst possible moment for the National Theatre to open," says Hall. "But socially and politically, it is the best. This is an unrivaled opportunity to put theater right into the center of our society's debate with itself." Peter Hall ends with a glance downstream toward the site of Shakespeare's playhouse. "For plays which treat the audience as the society they are addressing, it brings the idea of the great Globe itself back with a bang."

A foyer event: Australian comic Barry Humphries as "Edna Everidge" hawks copies of "her" cookbook.

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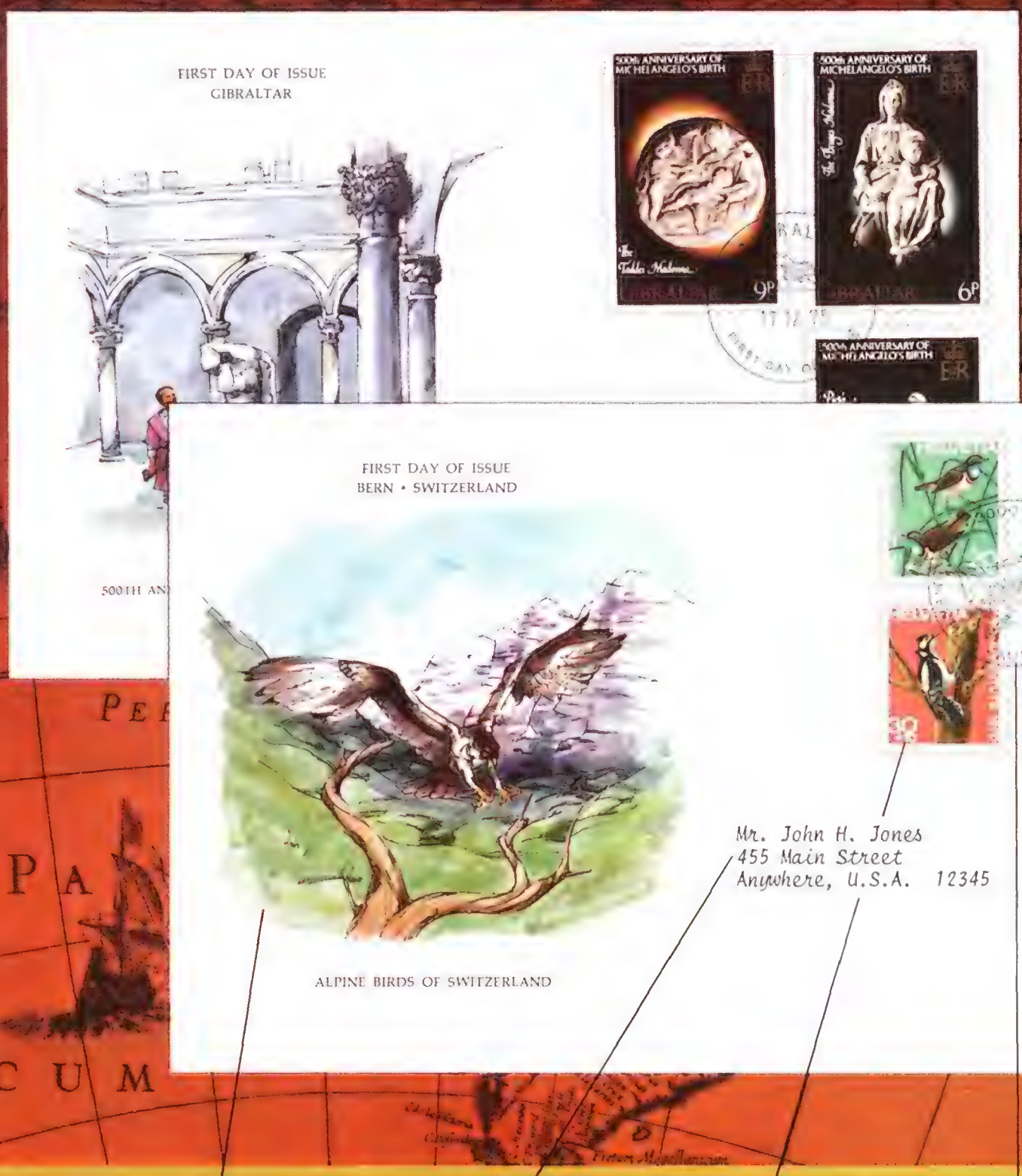

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Text and photographs by Douglas Faulkner

A still living fossil, the nautilus, glides through the ages

A success before dinosaurs walked the Earth, this cephalopod hides its geometric beauty in the depths of the tropical Pacific

X ray reveals spiral of sealed chambers (in white) that provide needed buoyancy to nautilus.

For the last 450 million years a cephalopod, related to squids and octopuses, but sporting a chambered shell, has roamed the world's oceans. Now-extinct species swam in the waters that at times covered Europe and Asia, Africa, Australia, Antarctica and the Americas. Today fewer than half a dozen of the 2,500 primitive species, all belonging to just one genus, survive.

The chambered nautilus, immortalized by the poet Oliver Wendell Holmes, is a remnant of a once-dominant group of animals. The squid and octopus evolved from nautiloidlike ancestors, but the nautilus itself is little changed. Compared with some of the nine- and 14-foot straight nautiloids that died out, today's coiled nautilus may be the meek inheriting the Earth.

The nautilus is indeed a living fossil. Its range is much more restricted now. The four or five known species collectively span the Philippines, Indonesia, Micronesia and Melanesia, still a vast stretch of ocean. This region with its rich diversity of marine species is the very hub of tropical oceanic life.

In New Caledonia I had my first opportunity to swim with the animal underwater and watch its jet-propelled mode of travel, see its pinhole-camera eyes, and watch it manipulate its tentaclelike appendages. After diving—and setting traps—in the Palau Islands for nine years, however, I had no success. Yet I knew they were living in Palauan waters, because they had been caught with handlines. Then one day I read that local fishermen in the Philippines were catching nautilus in 400 to 600 feet of water. I had been trying to trap them in much shallower water as I had done successfully in New Caledonia. It appears that 75 degrees is about the hottest they can stand and the surface waters of Palau and the Philippines reach 87 degrees. New Caledonia's surface waters are cooler, which explains why the nautilus there can ascend to within 20 feet of the surface.

Thus I proceeded to set a trap 400 feet down on the outer reef slope. A month later, as I was straining to haul in the last 30 feet of rope, I saw through the water two snow-white objects. Finally I was going to be diving with nautilus again.

There are at least three species, probably four and possibly five. Heinz Lowenstam of the California Institute of Technology has collected nautilus from different areas. When his immunology studies are complete, he hopes to know how closely related are the various species. In the meantime we have a roster of possible species based primarily on shell differences. *Nautilus pompilius* is by far the most common and widespread member of the group, as it lives not only in the Philippines but also southeastward to New Guinea, the Solomon Islands, Fiji and Samoa. *N. macromphalus* seems to be restricted entirely to New Caledonia and the Loyalty Islands. *N. scrobiculatus* ranges the waters of the Solomon Islands and Papua New Guinea, while *N. repertus* (the largest member of the group) may frequent the waters of western Australia and, possibly, the Palau Islands and eastward through the Carolines. *N. stenomphalus,* a disputed species, has

The pinhole eye (black dot at center) of a nautilus stares unblinkingly at the underwater camera. Note the sensory tentacles to the left and the right of the eye. This individual is an adult female.

A nautilus extends its arms to their fullest as it eats a fish head. Crabs and shrimp are normal food.

been reported near New Guinea and New Caledonia.

When swimming with a chambered nautilus, a diver first notices that its basic means of locomotion is a funnel-shaped "hyponome," which expels water much like the siphon jet of an octopus or squid. The nautilus hyponome is not a closed tube, however, for the lower portion is not continuous; rather, the two flaps of the hyponome overlap. The hyponome is very flexible and can be shaped to form a wide or narrow funnel, turned from side to side to pivot the animal right or left, or extended out and down under the leading edge of the shell to propel it forward. Squids and octopuses, when alarmed, can jet themselves about much more rapidly than nautilus.

A diver wearing swim fins can easily overtake a swimming nautilus, but in its dark world survival depends on adaptations other than speed, including its hard shell, relatively large size, and nocturnal activity. Its many filamentlike arms act not only as organs of touch but also of smell. When a nautilus is swimming forward or looking for food, or perhaps a mate, the long tentacles are extended.

Octopuses have eight arms; squid and cuttlefish have eight arms and two longer tentacles. Nautilus have several dozen digital arms plus small sensory tentacles ahead of and behind each eye. When a nautilus is searching out a crab or shrimp, it first extends the sensory tentacles, then the main cluster of arms. These are spread into what has been called a "cone of search," like cat's whiskers, to feel spatially and to smell out that shrimp or crab. When the nautilus finally locates a shrimp, an inner ring of arms thrusts out to grasp the victim, afterward drawing it in to a parrotlike beak.

The arms, unlike squid and octopus arms, have no rows of suckers. Instead, each is lined with grooves and ridges that are adhesive.

The protective hood of the animal evolved from tentacle sheaths. When the nautilus is alarmed it may pull in its arms and completely retract within its living chamber. Only the tough muscular hood is exposed at the shell's entrance. A nautilus cannot breathe very well in this mode, however, so it does not remain closed up for long.

The animal's pinhole-camera eyes are simple compared to eyes using lenses. In the darkened world where the nautilus lives, however, pinhole eyes are sufficient for its needs. In the nautilus world the arms are the preferred information-gathering organs. Nautilus eyes must be quite sensitive to light, for the animal is basically nocturnal, at least when making forays into shallow water. When a nautilus is released from a trap during the day, both males and females immediately swim to where the light level is lower, usually back to deep water. The eye of a nautilus must be more sensitive to low light levels than our own and, despite the fact that we have lenses, we would be hard pressed to make much use of them at the depths at which the nautilus lives, especially at night.

Behind the arms, the eyes and the hooded exterior are the animal's internal organs. Breathing is linked with locomotion. Since water can be a propellant and equally a source of dissolved oxygen necessary

The author is now in the Solomon Islands taking more nautilus photographs for a future book.

A nautilus retracts into shell (note eye position); food is scattered by jet of water from the hyponome.

Some 150 feet down a female (top) with extended arm tips clings to a swimming male with retracted tips.

for respiration, the two functions are combined in one economic inflow-outflow system. Seawater is drawn into the mantle cavity behind the eyes and drawn downward over four gills where an exchange of gases occurs. Then the water is forced out the hyponome. A flap of mantle behind each eye prevents water from flowing back, thus ensuring the flow of water in the proper direction and permitting a new volume of water to be inhaled each time.

The nautilus is literally a "blue blood." While human blood has an iron base and is therefore red, nautilus blood, and the blood of most other mollusks, the annelid worms and crustaceans, has a copper base of hemocyanin, which is blue in color. Copper-based blood does not clot, but thousands of gastropods (snails) and cephalopods control bleeding by other techniques, such as rapid wound closing.

Four branchial veins carry oxygenated blood from the gills to the heart, where it is pumped out through five aortas to the rest of the body. Returning venous blood does not run in closed vessels, but collects in many irregular, intercommunicating spaces in and around the organs and muscles, then moves to a space around the esophagus and liver where food is taken up and the blood is cleaned. From this cavity, known as the hemocoele, the blood flows down into the vena cava and back to the gills for a new cycle.

One feature of the nautilus circulation system, the siphuncle, has been much studied by scientists because it plays such an important role in the chamber formation. The siphuncle is a spaghettilike extension of the fleshy mantle that surrounds the nautilus' internal organs. (The mantle lays down the nautilus shell.) The siphuncle runs through the center of the shell chambers, a living connection between the 27 to 36 septal walls depending on the species and age. The siphuncle is made up of fibrous protein and a discontinuously shell-like layer surrounding the inner siphuncle cord. In cross section the siphuncle cord has a small artery and a large vein surrounded by numerous interconnecting blood lacunae which facilitate the return flow of the venous blood back to the gills and heart. The siphuncle is a continuing link to the animal's past.

It has been suggested that the embryonic nautilus lives its early life within an egg case deposited on a rock by the female. Each embryo develops within the egg case until several chambers are formed. Scientists theorize that at this point the baby nautilus hatches from the egg case, and the shock of this event is accompanied by a reduction in size of several chambers. Evidence for this is the presence of breaks in the shell which appear after the young hatch and are repaired as the nautilus grows. The shell of the young nautilus is covered with irregular brown stripings that render it inconspicuous. As the animal grows, however, the stripes are left off. Males tend to have wider white

spaces between stripes, but the pattern of each animal is unique.

Arthur Martin of the University of Washington and Peter Ward of Ohio State University studied the growth rate of *N. macromphalus* in New Caledonia. They counted the daily growth bands on the shell, and found the average adult had about 1,000 growth lines on it, with the largest specimen having 1,300 lines. Given this information, they figured that *N. macromphalus* probably adds a new chamber to its shell every 35 to 40 days, attaining full growth in about three years.

The nautilus is connected to its shell by a muscle on each side of its body, located behind the eyes. As the nautilus grows, it slides the muscles forward along the shell wall. As it moves forward, the siphuncular cord grows correspondingly in length. As space is created between the animal and the outer wall of the last chamber, a saline body fluid fills it. Then, the mantle covering the visceral sac secretes a thin fibrous membrane—the beginning of a new chamber wall.

Over a period of days the membrane is layered over with successive secretions that become mother-of-pearl. When the new septal wall is strong enough, the chamber fluid is removed through the siphuncle, a process which takes about 20 days. If the fluid were to remain in the chambers, they would not serve the basic purpose for which they evolved, to provide buoyance so that the nautilus can remain suspended in the water without effort. Such an arrangement is in marked contrast to some others mollusks that must drag their shells about as they inch along the bottom.

Ward thinks the nautilus travel in groups because, when feeding, they compete. In the aquarium, when a small nautilus is given a piece of fish or crab, a large nautilus often will swim over and attempt to take it away, at which time, as Ward has observed, "the small nautilus will swim vigorously away from its competitor. In these fights, two nautilus will often devour the same piece of food from opposite ends."

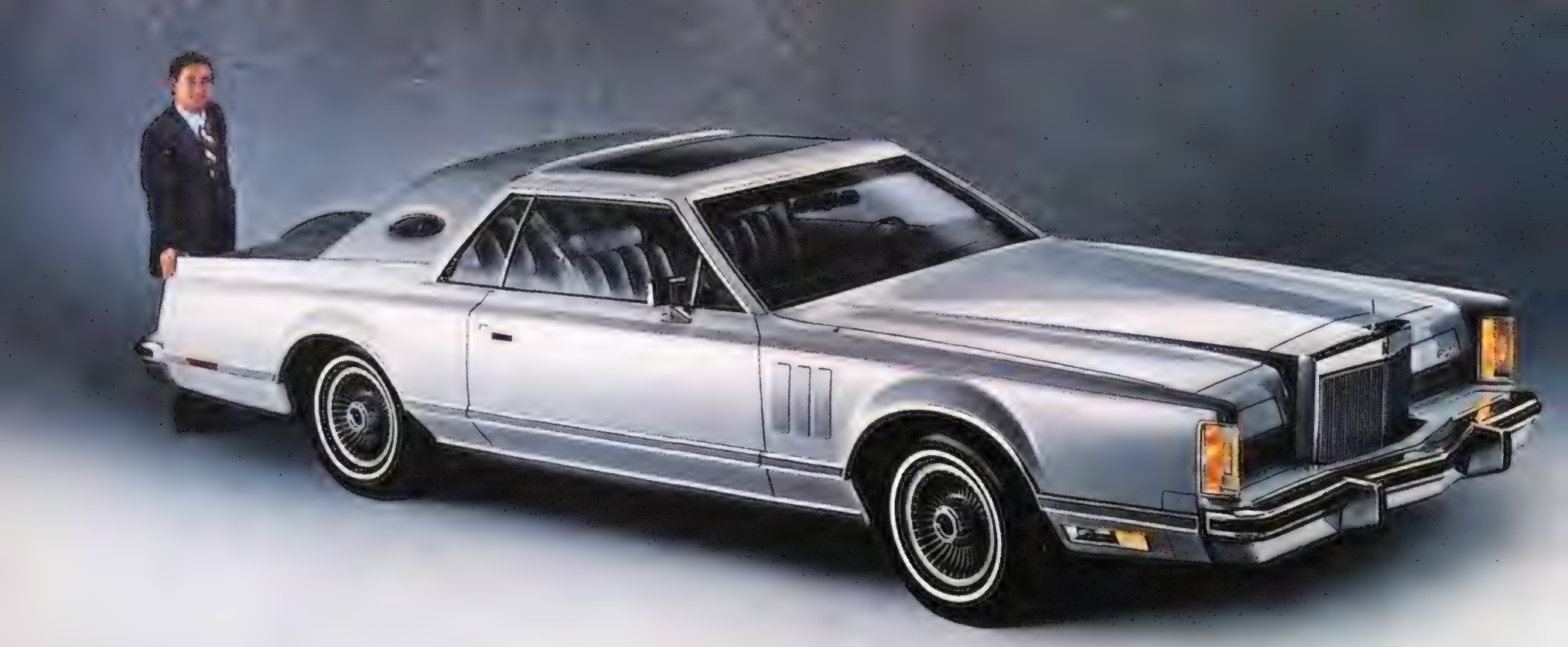
One night Ward was diving off the outer reef of New Caledonia when he came upon a nautilus swimming vigorously ten feet above the bottom. Clasped between its arms was the cast-off molt of a spiny lobster's shell. Because there was no meat on the shell, Ward wondered if the nautilus considered the molt food, or was simply attracted to the molt because of the strong lobster smell. Later, in Fiji, he watched nautilus crunch up crabs and shrimps and eat them, shells and all, and speculated on this behavior as a possible method of obtaining minerals, especially calcium, which is an essential element in the construction of the nautilus shell.

It would seem that a nautilus shell would be a secure home for its inhabitant. Not always so. Animals such as bryozoans, tube worms and barnacles encrust the shell, although with no observed harm done to their host. But a near relative, the octopus, may be a major nautilus predator. Very often drift shells have one or more small holes drilled through the bottom of the shell in the area of the living chamber.

"These holes are rather roughly excavated compared to those of other shell borers," explains Ward. He says that it is common in temperate waters for octopuses to drill holes in clam and snail shells by rasping away a rough hole with their radular tongues. Once the hole extends through the shell, the octopus injects a neurotoxin into the body of the prey. Ward believes that, possibly, nautilus also eat each other. The octopus or nautilus knows just where to drill: where the nautilus is most vulnerable and least able to defend itself. One large male nautilus from Palau had four or five drill holes in the shell. Some had been sealed over from the inside. The nautilus was having a running battle with its octopus adversary. And, in fact, it might still be alive to fight again today had it not found its way into the trap.

To this day, however, very little is known about the biology of the nautilus under natural circumstances. In late 1975 a group of scientists sailed to the Philippines aboard the *Alpha Helix*, a national research vessel operated by the Scripps Institution of Oceanography, to study nothing but nautilus. That data is being analyzed now, and another expedition will sail in 1979. After that we may know a good deal more about why this veteran of the primordial ocean keeps doing so well.

With shell removed, featherlike gills, mantle with siphuncle (lower half) and hyponome flaps can be seen.



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CONTINENTAL MARK V

LINCOLN-MERCURY DIVISION Ford

By Miyeko Murase

A recent arrival in the ranks of great collectors

Jackson and Mary Burke, in a little more than ten years, formed a rare collection of Japanese art, now on view to the public

One of the most notable and discriminating private collections of Japanese art anywhere in the world—excepting only Japan itself—was put together by Mary Griggs Burke and her late husband, Jackson, in little more than ten years. Although they had occasionally lent selected objects to public exhibitions, it was not until a Metropolitan Museum of Art showing in New York in November and December 1975 that any awareness of the actual size and quality of the collection became known to other than friends and a small circle of connoisseurs.

That first public showing consisted of art ranging from the seventh to the 19th centuries: 23 sculptures and other objects, and 86 paintings in a variety of formats including handscrolls, hanging scrolls, album leaves, fans and screens. These pieces represented only a small percentage of the Burke collection, but their range and consistently high quality were so impressive that Mary and Jackson Burke were suddenly catapulted into the front rank of Oriental art collectors. The objects exhibited in New York have since been shown at the Seattle Art Museum in March and April of this year and will be on view at the Minneapolis Institute of Arts through July 17.

Since serious collecting of Japanese arts is a fairly recent occupation in Europe and the United States, sizable private collections are still rare. The largest collections outside Japan were formed by Ernest Fenollosa, William Bigelow and Charles Freer in the late 19th century. These private collections formed the

Delicacy of feeling, exquisite techniques, a sensitive ordering of space and a hint of

sensuality characterize this hanging scroll painting on silk by Ogawa Haritsu (1663-1747).

Ink on silk, *Orchids, Bamboo, Thorns and Rocks,* by Tesshū Tokusai, a 14th-century monk and painter.

basis of the superb holdings now owned by the Boston Museum of Fine Arts and the Freer Gallery of the Smithsonian Institution.

Although they had acquired a few Chinese and Japanese art objects from time to time, it was not until 1963 that the Burkes began collecting seriously. That year they bought a large number of *Ukiyo-e* paintings from a private collector. *Ukiyo-e,* or "pictures of the floating world," are best known to the West in wood-block prints. It is a fact of modern art history that French artists "discovered" *Ukiyo-e* in the 19th century, and the prints influenced the works of Degas, van Gogh, Mary Cassatt and others. Japanese wood-block prints were a plebeian art form intended for the masses of old Tokyo, then known as Edo. The 18th- and 19th-century paintings that the Burkes purchased similarly depicted courtesans and Kabuki actors. Figure paintings such as Haritsu's (1663-1747; pp. 84-85), showing a demure young woman resting on a veranda after her evening bath, are easy for Westerners to appreciate, since they do not require any special knowledge of Japanese history, literature or religion, nor do they impose new esthetic demands.

To many Westerners, *Ukiyo-e* prints and paintings are synonymous with Japanese art, but they represent the last development in a long history of the traditional arts. For the Burkes, too, *Ukiyo-e* was an easy introduction to the arts of Japan, but they did not stay long within this single genre. They became curious about the precedents to *Ukiyo-e,* and they showed an unusual interest in various arts of different periods.

The collection now contains diverse objects both ancient and modern, such as Buddhist and Shinto sculptures, illustrated Buddhist scriptures and ritual utensils, calligraphy, lacquer furniture and boxes, large ceramic storage jars and small tea bowls and paintings. All the major schools of Japanese painting —by far the largest portion of the collection—are represented. The Burkes delved into the esoteric mysteries of religious iconography and the sophisticated esthetics of Zen ink painting. They enjoyed the poignancy and humor of the narrative handscrolls and admired the brilliant designs on decorative screens. They also learned that the 18th- and 19th-century *Nanga* (Southern School painting) artists, who were inspired by learned Chinese philosophers, were a world apart from their contemporaries, who painted the sensuous and pleasure-loving denizens of *Ukiyo-e.*

Mary Burke attributes her love for things Japanese to her early acquaintance with Oriental culture. She

was born and raised in a St. Paul house built in the mid-19th-century "Italianate" architectural style that was furnished with European antiques and decorative articles from the Orient. She made her first trip to Japan in 1954 to study gardens, because she was then planning a garden for one of her homes. But by that time she already was engaged in the serious study of Oriental culture at Columbia University.

Jackson Burke, who died in 1975, was gifted with sharp esthetic perceptions and a discerning eye—talents that account for the enduring contribution he made to the world of printing with his innovative typeface designs. In his later years, collecting Japanese arts was the avenue through which he expressed his creative energy and sensitivity. Together the Burkes had the ability to separate the genuine from the false and to discover the greatness of true simplicity as distinct from the contrived and artificial.

Their discernment is clearly reflected in the collection. For example, in scope and quality the Burke holdings in ink paintings are unparalleled outside Japan. Often considered the most difficult among the many styles of Japanese painting, these subtle, introspective works held a particular fascination for the Burkes. Ink painting was introduced to Japan from China in the 13th century together with the tenets of Zen Buddhism. Since its early practitioners were Zen monks, ink painting by association was the handmaiden of religion. Yet these paintings were not made as icons for worship, but as vehicles for mental and spiritual exercises. Ink paintings are executed on paper or silk without preliminary drawings. Because it is a technique that allows no chance for alteration, ink painting corresponds to the similar Zen belief in a spontaneous and intuitive grasp of truth. An act of painting that achieved a visual maximum with seemingly minimal effort was thus for some painters a means to religious enlightenment.

The painting by Tesshū Tokusai (opposite), a scholar-monk-painter of the mid-14th century, is a good example of the Zen approach. This simple composition is a marvel of brush technique, contrasting broad turning strokes for the craggy rocks, short dark strokes for bamboo, and long resilient curves for the bladelike leaves of the wild orchid. Tesshū Tokusai was one of many medieval Japanese artists whose education integrated the sacred and secular.

In a detail of a painting by Reisai (p. 89), a monk-painter of the mid-15th century, a venerable Zen patriarch named Bukan sits on a stone near the edge of a

Hanging scroll on silk, *Autumn Flowers* by Yamamoto Baiitsu is fine example of *Nanga* school.

A six-fold screen of color on gilded paper, this work of high art is entitled *Tagasode* (Whose Sleeves?).

cliff as he stares into a mist-filled abyss. Bukan's constant companion, a docile pet tiger, lies curled in peaceful sleep in the shadow of the rock. This detail belongs to the right panel of a diptych which consists of two long and narrow hanging scrolls (38 by 13⅝ inches each). Bukan's two eccentric disciples are portrayed on the left panel. The figures in these paintings occupy only the bottom third of the scrolls. This kind of scroll illustrates a principle peculiar to ink paintings—that "less is more," a curious logic based on a refined Chinese perception that unfilled space is more evocative of mood than is filled space.

The subtleties of medieval Japanese ink painting were drastically transformed in the 16th century into a decorative art used to embellish large rooms in castles and palaces. Painters like Kanō Sanraku (1559-1635), who painted a screen depicting views of the West Lake, a famous scenic spot in south China, made the Chinese ink style much bolder by using clear, obvious outlines and large forms. This detail (at right) is but a tiny part of a vast panorama on a pair of screens that unfolds with a variety of perspectives, both near and far, and pictorial references to the four seasons.

The decorative screens represent a high point in the history of Japanese art, and the Burke collection includes a number of important examples. One of these is the splendid early 17th-century screen with the evocative title, *Tagasode* (Whose Sleeves?; above). Two squared black and gold clothes racks, the sleek curve of the *koto* (a 13-stringed musical instrument) at the bottom and a small triangle formed by a tubular amulet hanging by a tasseled cord from the clothes racks create a series of severe geometric patterns

Detail of a panel from a pair of 17th-century sumptuous screens of ink, color and gold.

Born and raised in Japan, Miyeko Murase is at present professor of art history, Department of Art History and Archaeology, Columbia University.

A pillow word (leading into a poem), *tagasode* was used poetically to lament the absence of a lady.

Detail of half of a diptych, *Bukan, Kanzan, and Jittoku,* 15th century: Bukan with small tiger, behind rock.

against a neutral gold ground. The harsh severity of the composition device is softened, however, by the brightly decorated kimonos hanging on the racks. This is a daring composition: there is no indication of floor, no suggestion of depth. It is a painting reminiscent of still-life paintings like those of the 18th-century French painter Chardin. Yet, while Western still-life paintings are largely devoid of any literary meaning, Japanese paintings like this screen often conceal literary allusions. The word *tagasode* has poetic associations, for it was frequently used in medieval poems that gently lament the absence of a woman. The Burke screen is a special treasure because it is the oldest extant example of this type.

Ancient literature, such as love stories, historical tales and religious legends, made a unique contribution to art, because the Japanese continued to read and illustrate these stories for centuries after their creation. The Burkes shared a particular fondness for the most celebrated of romances, the *Tale of Genji,* which is the world's first true novel, written around A.D. 1000 by Lady Murasaki. The collection includes numerous objects that depict the adventures of Prince Genji and the courtly life of his time.

The handscrolls that illustrate narrative themes are called *emaki,* in which Japanese painters conveyed the emotions and moods of their characters as they related the stories. Against the long horizontal format, they also created a vivid sense of shifting time and space. This superb illustrative technique, which anticipates modern cinematic techniques, is unmatched anywhere in the world. The majority of Japanese *emaki* produced from the 12th through the 14th centuries are in public collections today, and only fragments are available to private collectors. The Burke collection includes a number that preserve a tantalizing glimpse of these medieval achievements.

Bold, brilliant designs of Rimpa

Another ancient romance, the tenth-century *Tales of Ise,* was standard subject matter in the repertory of a 17th-century decorative school called *Rimpa.* The bold, brilliant designs of the *Rimpa* school enjoy particular esteem among American and Japanese collectors alike. A small album leaf illustrating an episode during a journey by the *Ise's* hero was painted by Sōtatsu (died c. 1640; p. 91), one of the *Rimpa* founders, and it is among the artist's best-known works. The fluid calligraphic inscription, written by an anonymous calligrapher, is a 31-syllable poem *(waka)* from the narrative that expresses the courtier's longing for a friend left behind. In spite of its small size (the painting measures just over nine by eight inches), this album leaf has monumentality and a poignant, sensu-

Mary Griggs Burke cannot recall when she was not sensitive to the arts and culture of Japan and China.

ous beauty that epitomizes the Japanese love for abstract patterns and striking visual richness.

The Burkes' small but important collection of pottery represents still another aspect of Japanese esthetics to which they pay particular homage. Many Westerners are familiar with delicate Chinese porcelains that mark a high point in the artistic and technical achievements of the Chinese. Japanese potters, too, made porcelains, but their pottery of the 16th and 17th centuries defied Chinese ideals. These ceramics have coarse, heavy bodies; often they are irregularly shaped and glazed, and even cracked. In another time or in a different culture, they might have been discarded as rejects. Yet their bold, simple forms, tactile surfaces and free decorations appeal to 20th-century tastes, because they exude a power and immediacy that remind us of modern abstract sculptures.

Among the paintings in the Burke collection considerable attention is devoted to *Nanga,* or Southern School painting. *Nanga* paintings represent Japan's last preoccupation with Chinese esthetics and models. Numerous artists worked with *Nanga* styles during the 18th and 19th centuries, and all the major artists are represented in the Burke collection by choice examples. The style of the delicate scroll which depicts early autumn flowers by Baiitsu (1783-1856; p. 87) can be traced to Chinese paintings of the flower-and-bird genre. Yet this painting also shows an irregular use of chiaroscuro and the suggestion of real space, traits that reveal an awareness by *Nanga* artists of a Western brand of realism which was then filtering through Japan's self-imposed isolation.

The Burkes were fortunate to have the warm support and cooperation of Japanese scholars and government officials in their collecting activity. This fact has had singular importance for their pursuits, because the Japanese government takes a serious interest in the proper preservation of its ancient arts and is stringent, to say the least, about art objects sent abroad. The Japanese welcomed the Burkes, because they recognized in them a sympathy of values, determination and altruistic intentions.

The size and scope of the Burke collection is the result of interest and careful buying. The Burkes never intended their collection to be a comprehensive one; instead, they let their personal taste dictate acquisitions, concentrating on quality.

What a joy for the lover of art and the student of Japan alike that this remarkable collection is being made visible to a wider public.

An illustration by Sōtatsu (died c. 1640) of tenth-century *Tales of Ise* is an example of *Rimpa* school.

Charles Eliot II, Mrs. William Wigglesworth, Sidney Shurcliff on Grande Allée of Crane Reservation.

Yankee heritage is secured without government aid

The Trustees of Reservations, the nation's oldest independent preservation group, since 1891 has been rescuing splendid sites and landscapes

By Frederick John Pratson

Photographs by Alfred Eisenstaedt

The gusts and bellows of a southwest wind sheared across the cool waters of the Essex River estuary, combing the grass of the open field 200 yards ahead of us. A doe and her fawn grazed there; birds maneuvered in the cobalt skies. I had quit the stifling humidity of Boston to inspect the Cornelius and Miné S. Crane Wildlife Refuge, a 700-acre North Shore sanctuary of islands, salt marsh and sand dunes protected from commercialization in perpetuity by The Trustees of Reservations of Massachusetts.

"The whole area," Nancy Piatczyc said with a sweep of her arm, "was once overrun by sheep, but in recent years the native plants have made a substantial comeback." Nancy is a Trustees staff member. She and her husband David came as newlyweds to live on Hog Island, the nucleus of the refuge, in 1976.

She handed me her binoculars and I made a quick scan of the terrain. Hog is a drumlin, an oval hill of glacial drift, dominated by spruces. First settled in 1655, it remained an isolated farming community until recent times. A house constructed by Thomas Choate in 1740 still stands (pp. 96-97), a salient reminder of the Colonial past, when the island was a day-long sail from Boston. Hog was given to The Trustees of Reservations, the nation's oldest independent preservationist group, by Mrs. Crane in memory of her husband Cornelius, who is buried here. The refuge serves as a major and essential stopover for numerous migratory waterfowl.

Aristocracy in action

Earlier in the day refuge manager Walter Prisby told me that Miné Crane would say to him, "Wally, this is my kingdom." As a result of her generosity, this kingdom in the Essex estuary, which otherwise surely would have fallen to the developers and speculators, still educates the public and benefits our endangered ecosystem as a whole.

"Let's see how close we can get to the deer," Nancy whispered. It is her job to take periodic inventories of the natural resources of the refuge and to conduct field trips for visitors. The fawn had vanished. Suddenly, from a thicket of brush two bucks leaped out and, with the doe, headed away from us across the salt marsh toward a dense forest. The three stopped their flight at the edge of an inlet whose waters were rising rapidly with the tide, and which was now too broad for them to cross. The deer turned and faced us indecisively. We kept advancing upon them out of delight at being so close to these wild, innocent and graceful creatures. As we approached, one of them pranced boldly in our direction, then lost its confidence and dashed through the salt grass with the other two at its heels.

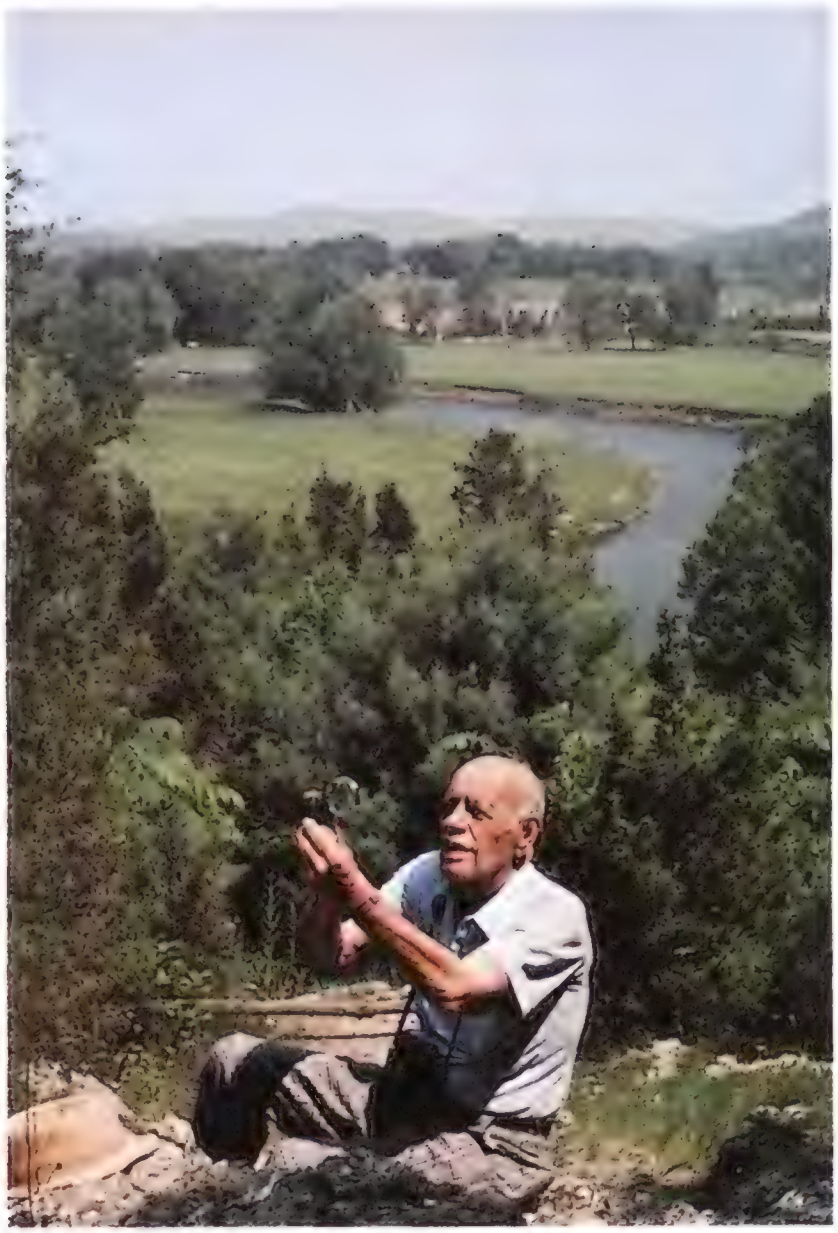
Castle Hill, Crane "cottage" designed by David Adler, has some details reminiscent of Christopher Wren.

I had a feeling the fawn was somewhere near us. We rustled about in the underbrush for a minute and discovered it curled up on the ground, motionless. The baby deer was almost perfectly camouflaged with a mottled tan and white coat, except for its moist ebony nose. Finding the fawn was the event of the day, and it occurred within a short distance from Megalopolis itself, all because generous donors had provided land in its natural state and because The Trustees was there to safeguard this heritage.

As I left the refuge, I could see the fawn and its mother grazing peacefully in the far distance as though our intrusion had never happened.

A special vision had made this all possible. The Trustees of Reservations of Massachusetts was conceived in the mind of a visionary. Charles Eliot, disciple of Frederick Law Olmsted, the dean of America's landscape architects, and son of Charles William Eliot, the legendary President of Harvard (1869-1909), was one of the first to recognize the social importance of open space, those "bits of scenery which possess uncommon beauty and . . . refreshing power." He and a few others of similar philosophy made up their minds to establish an organization "empowered by the state to hold small and well-distributed parcels of land, free of taxes, just as the public library holds books and the art museum pictures, for the use and the enjoyment of the public."

What made this point of view unusual was that Eliot and his friends lived in late 19th-century America, a time when most people still viewed land in its natural state as unlimited or useless or even downright threatening. It would still be a few years before Teddy Roosevelt would try to save our best landscapes through



Nature writer Hal Borland examines closely one of flowering species at Bartholomew's Cobble.

Cape Poge Wildlife Refuge and lighthouse get a thorough going-over by outdoorsman Oliver Filley.

the National Park system. The mood of the country was solidly for expansion and development; the Industrial Revolution was in full flower. Cities were steadily encroaching upon nature, but had not open space been put there by the Almighty expressly for Man to exploit? Prosperity depended upon rapid consumption of resources—and that was more important to the common man than trees and animals.

Charles Eliot was not against "progress," but he reasoned that a balance had to be struck between converting the land to Man's economic needs and preserving it as a heritage for future generations and as an esthetic and psychological release from the pressures of rampant urbanization.

Eliot's vision had its origin in the uniquely inventive social climate of New England, which placed relentless emphasis upon hard work, ingenuity, determination and individualism. Francis Parkman saw these traits manifested in "the aggregate efforts of a busy multitude, each in his narrow circle toiling for himself, to gather competence or wealth." Competence was the key word, for money, once acquired in sufficient quantities, often loses its grip on the imagination. True to this philosophy, the Yankee mind, or at least its Brahmin cutting edge, soon turned from cash to good works. A solidly entrenched elite could better understand the anti-elitist Thoreau, who declared, "Philanthropy is almost the only virtue which is sufficiently appreciated by mankind."

This combination of Yankee ingenuity, access to wealth and power, and an almost religious desire to pursue worthwhile causes and make them into successful enterprises created a wide range of remarkable institutions which continue to thrive and to serve the public weal. In Massachusetts, for example, one finds the heaviest concentration of prestigious independent colleges and universities in the nation, top-rank teaching and research hospitals such as Massachusetts General, paragons of culture such as the Boston Museum of Fine Arts and the Boston Symphony Orchestra, and outstanding environmental organizations, of which the Massachusetts Audubon Society and The Trustees of Reservations are typical. The Trustees was founded by Charles Eliot and his associates in 1891. Six years later, shortly after Eliot died at 37, the Trustees acquired its then-largest property: 87-acre Mount Ann Park, in the seafaring community of Gloucester.

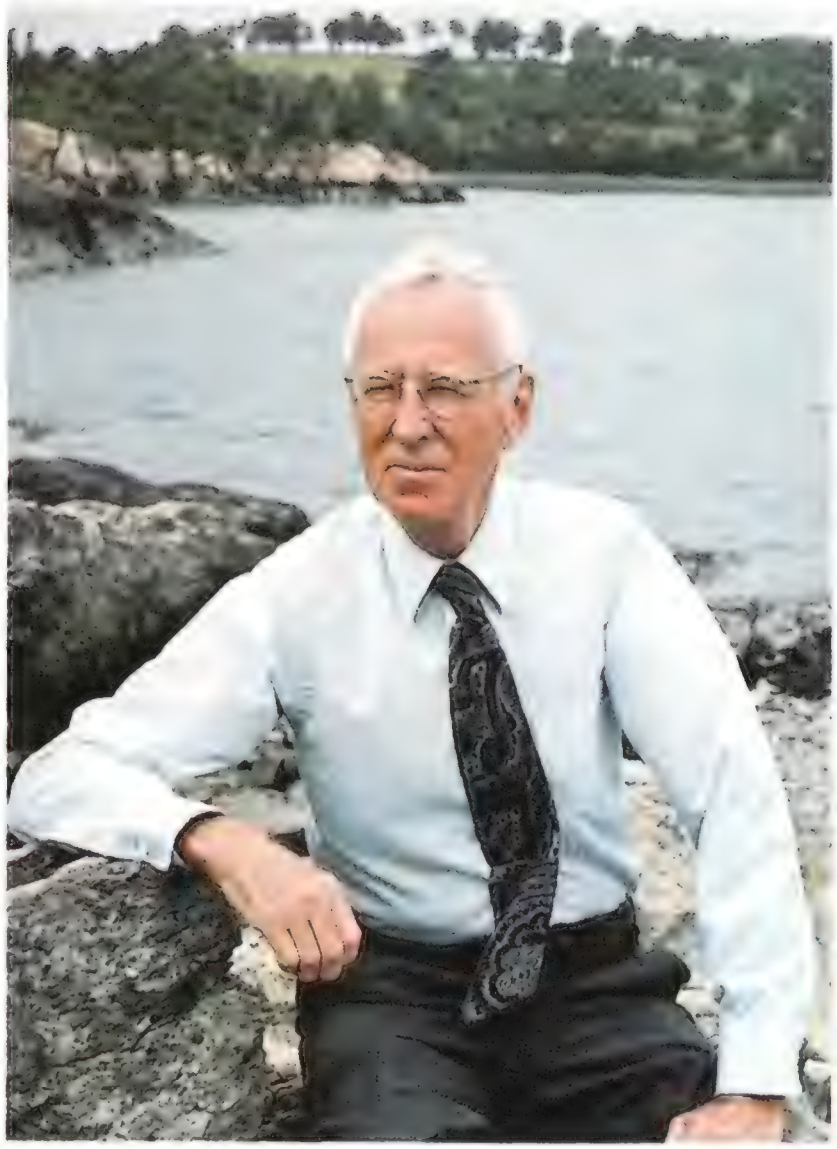
Eliot's enthusiasm survived him and continues in the present membership of The Trustees—such famous names as Adams, Ames, Bradford, Cabot, Conant, Coolidge, Forbes, Frothingham, Houghton, Loring,

Frederick John Pratson is a photographer, artist and author concentrating on the natural history and society of New England and Maritime Canada.

Putnam, Saltonstall and Sargent. Today, The Trustees of Reservations is custodian for 61 open-space and historic areas. These properties, all open to the public, total more than 18,000 acres and represent a diverse heritage of seashore and woodlands, riverbanks, streams, waterfalls, glens, hilltops, headlands, marshes and wetlands.

Many sites have unique botanical, geological or ornithological features. Bartholomew's Cobble, a National Natural Landmark in Ashley Falls, contains some 40 fern species and allies, one of the largest such concentrations in the United States. Three other properties are National Historic Landmarks—The Old Manse, adjacent to Minute Man National Historical Park in Concord, built by the grandfather of Ralph Waldo Emerson and once the home of Nathaniel Hawthorne; the William Cullen Bryant Homestead in Cummington, boyhood home of the poet; and The Mission House in Stockbridge, home of John Sergeant, Yale graduate and preacher to the Stockbridge Indians in the early 1700s.

Rear Admiral Andrew R. Mack (USN, ret.) at Mission House, home of Colonial preacher John Sergeant.



World's End peninsula, repeatedly threatened by "improvements," is visited by Theodore Chase.

Stephen V. C. Morris makes one of his regular tours of Naumkeag, built to plans by Stanford White.

Hog Island, centerpiece of Crane Wildlife Refuge, is a place of serenity just outside Boston. Neither

Most of The Trustees' historic houses are furnished with rare period pieces; one of the most exquisitely provided is the grand summer home of the Choate family in Stockbridge, called Naumkeag, built in 1885 to a design by Stanford White.

As I strolled through the house with Stanley Piatczyc, Nancy's father-in-law, and a contingent of garden club members from New York state, I found this 26-room shingle-style mansion to be a treasury of antiques: a large Aubusson rug in the front parlor, Canton and Delft china in the dining room, a Martin Luther platter on the fireplace mantel in the library, and Sheraton and Chippendale furniture in many rooms, just to name a few fine pieces. Although the house gave me a sense of the comforts of a long-gone era, I was most taken by Naumkeag's gardens, the special province of Mabel Choate, who donated the property. There reposes an enchanting miniworld of formal promenades and pagodas, fountains, terraces and a Chinese garden, whose serene temple might in time transform the roughest brute into a Mandarin philosopher (p. 98). With landscape architect Fletcher Steele Miss Choate created, over a period of 30 years, one of the most elegant formal gardens in America.

Primarily, The Trustees of Reservations acquires its properties as gifts from owners; it also raises the money to purchase a site which might otherwise be sacrificed to development. But all must meet precise requirements of environmental value and public service. The 1,352-acre Richard T. Crane jr. Memorial Reservation in Ipswich is an example.

This dramatic shoreline caught the eye of Captain John Smith, who perused it in 1614 and wrote lyrically in his log about its "rising hills" and "delightful groves." Later, the land was bought from the Indians by Puritan settlers under the leadership of John Winthrop jr. More than three centuries after Captain Smith's presence, the Cranes assembled a vast and splendid estate. On the crest of Castle Hill they built a country house which they used in the Newport manner as a "summer cottage," and which today is employed as a conference center and elegant setting for concerts and dances. It was designed by David Adler in a style reminiscent of Sir Christopher Wren's, and its magnificent formal gardens and spacious lawns were laid out by the Olmsted brothers and Arthur Shurcliff. Castle Hill rises majestically over a long, flawless beach where thousands of saltwater bathers and sun worshippers refresh themselves, and where those seeking knowledge of the natural environment of sand dunes, woodland and salt marsh can follow a specially marked interpretive trail.

In the South Shore community of Hingham lies another unique property, the 250-acre World's End Res-

nature nor the spread of exurbia has conquered the 237-year-old Thomas Choate house and environs.

ervation, a peninsula of dramatic topography, combining open fields and a variety of tree species. In the late 19th century, at the request of the owners, Frederick Law Olmsted created a plan to subdivide World's End into 150 house lots. The homes were never built, but access roadways following the contours of the land were planted on both sides with double rows of trees according to Olmsted's design. The land itself was farmed and finally maintained by its owners as a private park where, on occasion, invited guests rode to hounds. In 1967, World's End was threatened again by development, but this time it was saved for good by The Trustees with the help of massive public contributions. The following year The Trustees gave its coveted annual conservation award not to one individual, as is customary, but to "The People of Hingham and the South Shore."

Because The Trustees sees itself as a catalyst in helping the conservation efforts of others, it works closely with state and federal agencies, and even international groups. The Trustees provides information to landowners interested in preserving their properties, and services requests for assistance or information from conservation commissions, planning boards, community land and conservation trusts, historical societies, garden clubs and the general public.

A question of integrity

In 1971 the members voted to expand their corporate purposes to permit the taking of what are called "conservation easements." Through such restrictions, The Trustees protects Nashawena, second largest of the Elizabeth Islands dividing Vineyard Sound from Buzzards Bay; Prospect Hill, the highest point on the island of Martha's Vineyard; and acres of land bordering the Charles River in Dover and Sherborn, among others. In the area of research, The Trustees is continuing a census of colonial nesting birds at Cape Poge Wildlife Refuge and Wasque Reservation on Chappaquiddick Island. Daily records note the arrival, activities and nesting characteristics of snowy egrets, black-crowned night herons and Canada geese, as well as least and common terns. At the Crane Reservation a project to manage the area's white-tailed deer will seek population counts, and try to determine age composition of herds, plot ranges and patterns of movement, clarify the influence of weather on animal health and estimate the impact of ambient activity by human beings.

In an age when the government grant is considered by many organizations essential, The Trustees of Reservations goes its own way. But the organization does face serious financial problems. They were eloquently articulated by Charles W. Eliot II, nephew of the founder, city planner for Washington, D.C. under President Hoover, director of the National Resources Planning Board under FDR, professor of landscape architecture at Harvard and "conscience" of The Trustees. I chatted with him at his summer home on Argilla Road in Ipswich, within a comfortable walk of the Cranes' house. Eliot is a tall, robust man with a lion's mane of thick white hair.

"Our top priority for now and the future is to take the best possible care of what we already have . . . and which we have accepted in trust from the donors," Eliot declared. "If we don't do an honest job in fulfilling the expectations of the previous donors, we are not going to get any new ones. The person who gives us his property has had a special relationship with it, knows its natural history and the history of the people who have lived on it. . . . I always raise the question,

'Is this what the donor thought we were going to do with his gift?' "

Anyone can become a general member of The Trustees of Reservations by making a contribution of ten dollars, so it is not an exclusive group. Nevertheless, in the upper echelons the old Yankee Brahmin influence continues to be felt strongly. Besides the general membership there are some 150 members of the corporation, whose executive body, a 14-person standing committee, meets monthly. For most of the reservations there is a local committee, whose members are normally residents of the area in which the reservation is located and who oversee its operations.

A major portion of The Trustees' administrative load is borne by members voluntarily, but there is a small paid staff with headquarters in Milton, Massachusetts. Gordon Abbott, a lean, energetic man, is the director. In addition to running day-to-day operations, Abbott spends many of his evenings in local communities which seek advice on a wide variety of conservation matters, ranging from watershed problems to saving a historic river to protecting open space through easements. I asked Abbott about this extramural commitment.

"Ever since its beginnings, when The Trustees proposed the establishment of a metropolitan park system in Boston in 1891, the organization has worked with government and with other conservation agencies and groups to preserve beautiful and historic areas in the Commonwealth. Over the years, for example, we've initiated the now-computerized survey of landscape and natural areas in Massachusetts, and we have helped with the establishment of Harvard Forest in the town of Petersham, Borderlands State Park in Easton, the Parker River Wildlife Management Area in Ipswich, and Boston Harbor Islands State Park, to mention a few."

And what explained The Trustees' extraordinary record of success? "I think that the primary ingredient, from the very beginning, has been the quality of the members of its standing committees—their judgment, taste, independence and dedication to the purposes of our organization."

Toward the end of my expedition Foster Silva, superintendent of The Trustees' properties on Martha's Vineyard and Chappaquiddick, and I were jouncing along in his pickup on a rutted sand road in the Cape Poge Wildlife Refuge.

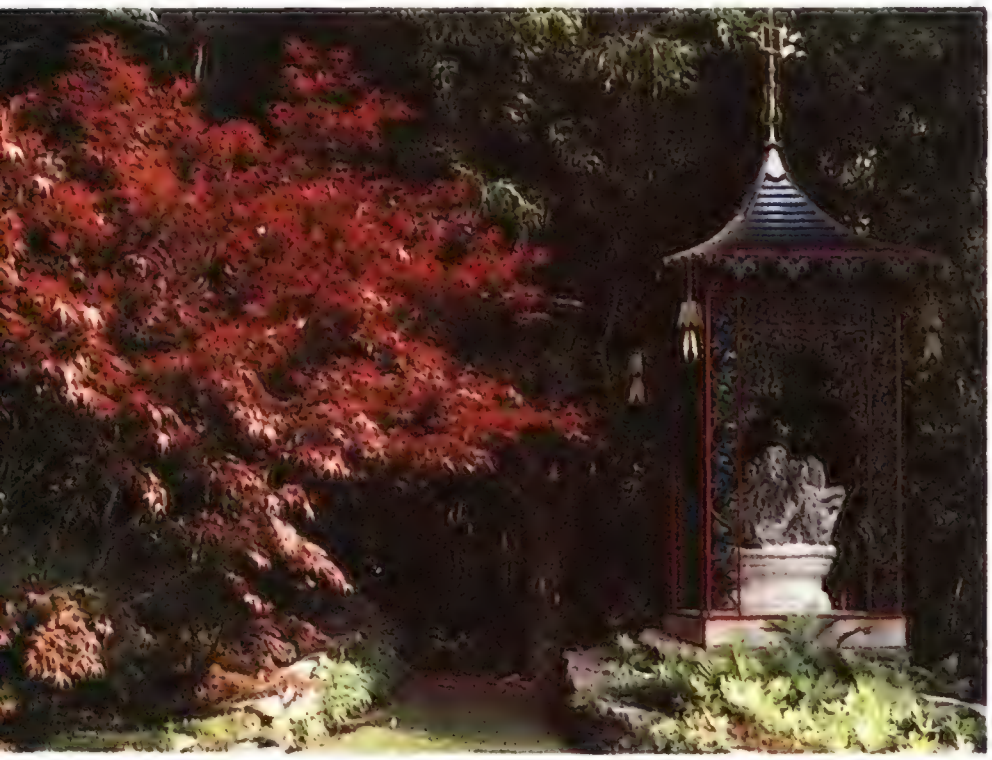
"This is the most beautiful and unspoiled beach on either island," Foster declared. "The Filley family gave it to The Trustees. Wasque Reservation, on the other side of Cape Poge, was saved from a 300-house development by the public who gave their money so that The Trustees could buy it. The Trustees saved Chappaquiddick from disaster."

As we rounded a bend in the road I saw some big, gray boulders lying near the water. One of the rocks lifted its head and pointed its nose in our direction. It was the biggest, plumpest harbor seal I had ever seen. I shouted to Foster to stop the truck, trying to jump out, but the seal cast his bulk in wavelike motions toward the sound and quickly slid beneath the surface.

"I know that seal. I visit with it almost every day and rub its belly with my broom. He just loves it. We're good friends," said Silva, a man who has seen much of the world but enjoys being a steward of nature best of all.

Lounging on the upper deck of the ferry returning to Woods Hole, I thought about The Trustees of Reservations and the men and women who made it go. Generosity, independence, integrity, foresight—they were all there, and they showed in the operational quality of the organization.

But the one characteristic I found everywhere, and which I believe to be The Trustees' strongest, is sheer dedication to the task of saving diminishing reserves of open space. The members take delight in waging discreet war against spoliation, and their ethos has spread across the land. As Emerson put it, "Nothing great was ever achieved without enthusiasm," and that The Trustees has in ample measure.



In Naumkeag's Chinese garden, the philosopher finds sanctuary from the rush and rabble of city life.

Mrs. Raymond Emerson, at 89 doyenne of The Old Manse in Concord, enjoys a brief respite before house.

By Herman J. Viola

How *did* an Indian chief really look?

One artist painted them; another copied him; lithographers copied copies. Smithsonian exhibit asks how 'perfect' are the likenesses

Both paintings courtesy of the Peabody Museum, Harvard University

The Winnebago chief Hoowaunneka (Little Elk) was painted by Charles Bird King in 1828.

"I consider the above copy, perfect; a perfect likeness of the man, who is known to me—and an exact copy of the original drawing . . . ." These words, jotted on a lithographed portrait of the Iowa chief Mahaskah, were written in April 1830 by Thomas L. McKenney, author, with James Hall, of the *History of the Indian Tribes of North America,* one of the nation's most ambitious pre-Civil War publishing projects. The 120 hand-colored lithographic portraits and biographical sketches of prominent American Indian men and women from the early 19th century, included in the three-volume work, have long been acclaimed important historical documents as well as works of art.

The project was launched little more than a decade after the first lithograph was published in the United States, and a decade before Nathaniel Currier made lithographs a household commodity.

The publishers continually touted their lithographs as "perfect likenesses," a claim that generally has not been questioned in the 130 years since the project was completed. But were the lithographed likenesses "perfect"? The importance of this question becomes apparent when the intricate publishing process is unraveled. The lithographs were inspired by a series of oil portraits by a Washington artist, Charles Bird King. His original oils were, however, copied in oil by another artist, Henry Inman, and it was from these copies that the lithographs were made. They were produced without the aid of any photoreproductive devices, so images had to be copied by hand at every stage. How valid then could the claim of "perfect likenesses" really be? An exhibit at the National Museum of History and Technology at the Smithsonian Institution addresses that question. On display are several King portraits as well as Inman and lithograph copies which allow the viewer to decide for himself.

The McKenney and Hall project took 15 years, five publishers and four lithographic houses to complete. Several firms were literally bankrupted by their efforts. Although McKenney conceived the project and the publication bears his name, he actually withdrew from the venture years before the final lithograph left the presses.

From 1816 to 1830, McKenney headed the nation's offices of Indian affairs and was a major figure in the reform movement of his day. Like other well-intentioned but misguided figures, he wished to eradicate native American culture by transforming Indians into carbon copies of their white neighbors. But McKenney also attempted to preserve and document for posterity the tangible evidences of that culture. His efforts produced the first museum in Washington, which he called The Archives of the American Indian.

The pride of McKenney's archives, which later went to the Smithsonian Institution, was the series of Indian portraits by King. Despite the fact that his own

Henry Inman's copy of Hoowaunneka clarifies the facial expression and the colors on the body.

Lithograph follows Inman closely, cutting out all background. Note the black-and-white beads.

father had been killed and scalped by Indians, King welcomed McKenney's proposal to paint portraits at government expense. He painted approximately 150 portraits of Indian visitors to the capital.

The portraits went to McKenney's cramped office in the War Department building which stood next to the White House. Before long, the office seemed to be papered with portraits and the place was a must for visitors to Washington. One admirer was Frances Trollope, our often caustic British critic, who wrote that "the walls are entirely covered with original portraits of all the chiefs who, from time to time, have come to negotiate with their great father, as they call the president." Jonathan Elliot gave the gallery extensive coverage in his 1830 guide to Washington. "But for this gallery," he declared, "our posterity would ask in vain—*'what sort of looking being was the red man of this country?'* In vain would the inquirers be told to *read* descriptions of him—these never could satisfy. He must be *seen* to be known."

In 1829 Jared Sparks, editor of the *North American Review* and later president of Harvard University, visited McKenney and casually suggested the idea of publishing the portraits. McKenney promptly entered into a contract with Samuel Bradford, a Philadelphia printer. He gave Bradford six portraits. Bradford handed them on to Cephas Childs, who had just opened a lithographic shop on Chestnut Street across from Independence Hall. Although Childs was a skilled craftsman himself, the most gifted member of his firm was his deaf-mute apprentice, Albert Newsam, whose specialty was copying oil portraits at a reduced size on stone. For $25 the customer received the stone and 25 lithographic prints. To enhance the prestige of his new enterprise, Childs soon convinced the noted portrait painter, Henry Inman, to become his partner.

Lithography made reproducing the portraits rather simple and inexpensive. The picture was drawn with a greasy crayon on a specially prepared stone. After the stone was dampened, ink adhered only to the drawing. Unlike the process for traditional wood or steel engravings, drawings could be made quickly, correcting them was easy and the stones could provide hundreds of crisp, clear prints. The lithographs, of course, still had to be colored by hand.

Once launched, the project suffered setbacks and financial reverses, any one of which could have been terminal. One of the cruelest was McKenney's dismissal from office by President Andrew Jackson, who disagreed with his Indian commissioner's philosophy on Indian affairs. This meant McKenney no longer controlled the Indian gallery.

Courtesy of Thornton Boileau

King's portrait of the Osage squaw Mohongo with her child has the softness and warmth of oils.

Lithograph of Mohongo and child hardens lines and stylizes their features and expressions.

No matter. He devised an ingenious strategy to complete his publication project. He prevailed on his former associates in the Indian office to box up and ship five or six portraits at a time to Philadelphia. After Inman had copied them in oil, the originals were returned and the copies given to the lithographic artist, who tediously translated the color portrait into a black-and-white image on stone. Most of the final prints, then, were copies (lithographs) of copies (Inman's oils) of King's original portraits.

A portrait was printed on a lithographic press and water-based paints were added by hand, using the Inman copy as a model. The coloring was expensive and complicated. Although stencils were sometimes used for sharp-edged areas, colors generally were applied freehand as in a modern paint-by-number picture.

At least one box of King's portraits was lost en route from Philadelphia. Once the lithographer forgot to identify the Indians he had copied. McKenney called testily to Washington for help. "The *stupe* of a Lithographist," he wrote, "forgot to inscribe the names."

Finances were always a problem. The specter of bankruptcy always dimmed McKenney's vision of colossal riches. There were never enough subscribers or partners with money. McKenney even prevailed on former President John Quincy Adams to help with the editing. Finally, after James Hall, who described himself as a bundle of "ardor and energy," agreed to do the writing, the project limped to completion.

How accurate are the lithographs? They and the portraits were made 20 years before the camera came into common use. Nevertheless, several of the Indians lived long enough to be photographed and they resemble in a superficial way their portraits done 30 years earlier. Comparisons with King's original portraits pose a problem because the original collection was destroyed in the Smithsonian fire of 1865. The King Indian portraits extant today come either from his personal collection or those he copied for sale.

Fortunately, we do have a few original charcoal sketches that King made as a preliminary step to painting a portrait. They have a warm insight King's oils often lack. According to Peter Marzio, associate curator of graphic arts at the Smithsonian National Museum of History and Technology and the person who conceived the idea of the Perfect Likenesses exhibit, "The academic rules of American portrait art in the first half of the 19th century at times seemed calculated to restrain an artist's insight. King, in his Indian portraits, was a painter who followed those rules. . . ."

As Marzio points out in his exhibit catalog, King's

Dr. Viola of Smithsonian's anthropology department recently wrote a book on Charles Bird King on which this article and the museum exhibit are based.

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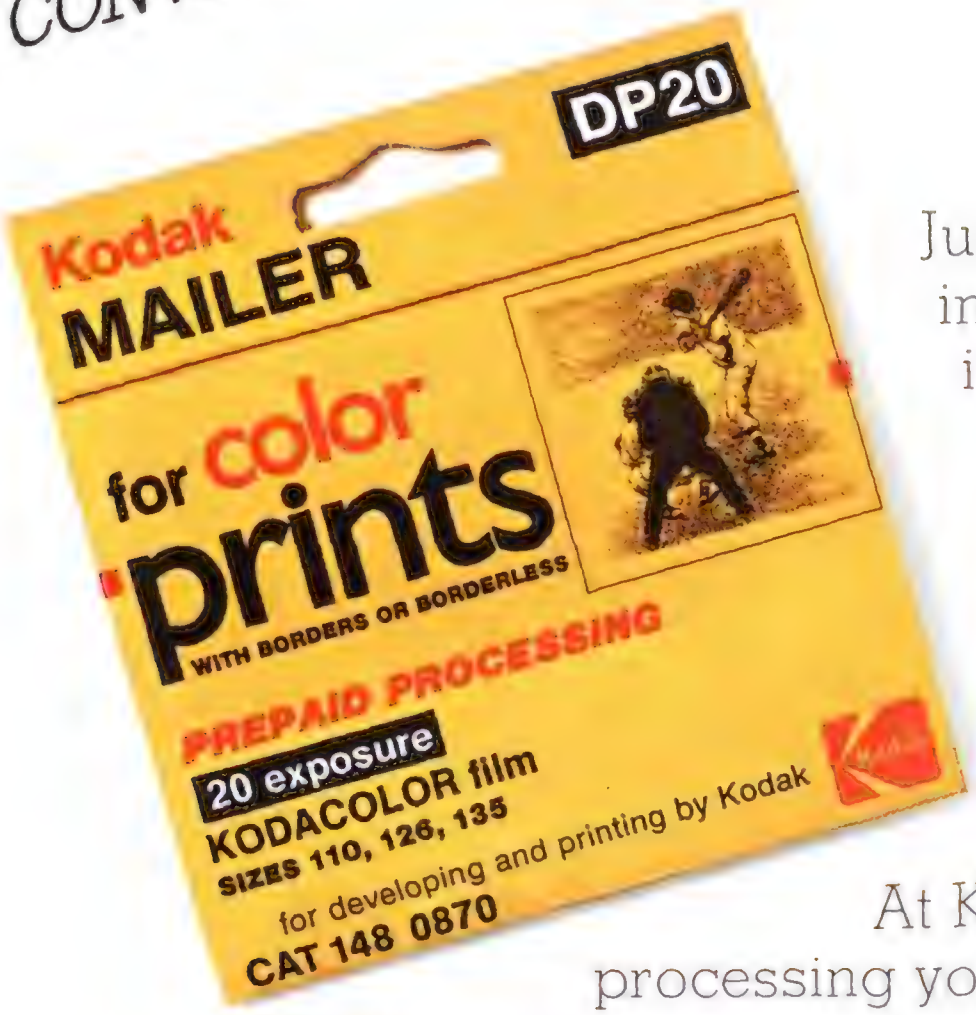

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oils were not intended for reproduction; the Inman copies were. It was Inman, schooled in both formal portraiture and the new field of lithography, who made possible the subtle transition from oil portrait to printed lithograph. Normally, lithographers preferred reproducing the works of painters who drew their subject matter in clear outline. Capturing in color the graduated colors, shapes and shadows of an oil painting was too difficult and expensive for pre-Civil War lithography. As Inman made his copies of the King portraits, he made certain adjustments. His copies have a harder edge; the figures, their individual parts, their colors, are all outlined. Presumably, Marzio notes, Inman painted in this style to make his pictures easier for the draftsman to copy on stone.

A succession of lithographers carried Inman's changes to extreme, either eliminating or greatly simplifying the backgrounds. Indeed, the portraits appear to have been silhouetted or cut out from a drawing book and pasted on the lithographic paper. "Clarity of the whole, clarity for every part, became the lithographic theme," Marzio points out. "Most subtleties or atmospheric effects created by King have been removed."

Watercolors on paper could not duplicate the warmth and texture of oils on canvas, so the lithographs are hard and bright. But why do some reds become green? Blues become yellow? Perhaps the changes were thought necessary to make the lithographs more attractive to the buying public. Some subjects were romanticized.

Despite many obvious and subtle changes, there is no evidence that the purchasers of the McKenney and Hall lithographs were displeased. Among the visitors to the showroom were Indians who either had sat for their portraits or knew the subject. Perhaps flattered, they attested to the "perfect likenesses."

Charles King's portrait of the Iowa Notchimine (No Heart), with ear ornaments, puckered eyebrows.

No Heart's photograph, taken some 30 years later, repeats worried look, the style of ear ornament.

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Century-old trunk owned by the author is made of pine-board slats covered with paper. One of the exhibits it holds is the lace-collared dress.

By Dolly Sherwood

Historical goodies crammed in old camelback trunks

Traveling West Virginia from school to school, 19th-century treasure chests display a bygone way of life

An old camelback trunk, enigmatic leftover from the past, has a dual personality. Sitting in an attic or basement, waiting to be rediscovered, it is a memory box, a quiescent container of clothing, letters, toys and other long-forgotten souvenirs. But once it was an active, mobile thing, when a family packed possessions in it and toted it from old country to new, or from one region of America to another more promising one.

Both roles are being emphasized in the West Virginia Heritage Trunk project, a traveling exhibit of reproductions, genuine artifacts and curriculum materials contained in antique trunks that ride circuit to schools all over the state.

The Children's Museum and Planetarium of Sunrise, Incorporated, in Charleston developed the project for the social studies division in the state's Department of Education. How, we were asked, could we enrich the prescribed eighth-grade curriculum? It was a challenge, for social studies, traditionally a rather dull catch-

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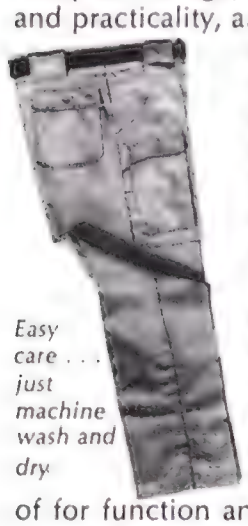

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all for history, geography and civics, is now expanding to include heritage history—finding out who we are. That's where a museum comes in, for museums are not only repositories but are involved in all sorts of bold outreach programs that enhance and enlarge education.

Money to fund the project came from the West Virginia Arts and Humanities Council, with matching funds and services from other agencies, including the Department of Education, which would circulate the exhibits to schools throughout the state.

We picked the time period of 1863-1873, West Virginia's first decade as a state. We were interested in the chronicles not of celebrities but of ordinary people of Civil War and Reconstruction times.

Our exhibits, we thought, must consist of things used in daily life—clothing, toys, books and documents—and they must be contained in antique camelback trunks—for realism and ease of shipping.

Talking to our elders yielded a harvest of anecdote and information. Mrs. Rebecca Morgan, old, charming and intelligent, shared stories that contributed importantly to the mood. From family memories passed on by her grandmother,

In classrooms, children can play this small mountain dulcimer.

Cornhusk doll shows how country people put together homemade toys.

we could reconstruct the life of a courageous woman who had to manage a farm and rear her children in a border area through which Union and Confederate armies marched and occupied, burning fences and commandeering food and horses. Her husband, a Confederate officer, was killed in a duel.

Fanny Cobb Carter was interviewed just before her 100th birthday. Mrs. Carter, a black, went to college and became an educator. Imagine talking to someone who remembered Booker T. Washington visiting at the home of her grandmother!

While reading, interviewing and writing went on, the search for trunks did, too. They fell into our laps from many sources—out of people's attics, from junkshops euphemistically called antique stores, and from basements where they had been gathering dust.

Thirty-six characters emerged from the reading and interviewing, roles to be assumed by an entire classroom. Role-playing is at the heart of the project. A trunk traveling as an exhibit would be interesting enough, but it might serve only as a

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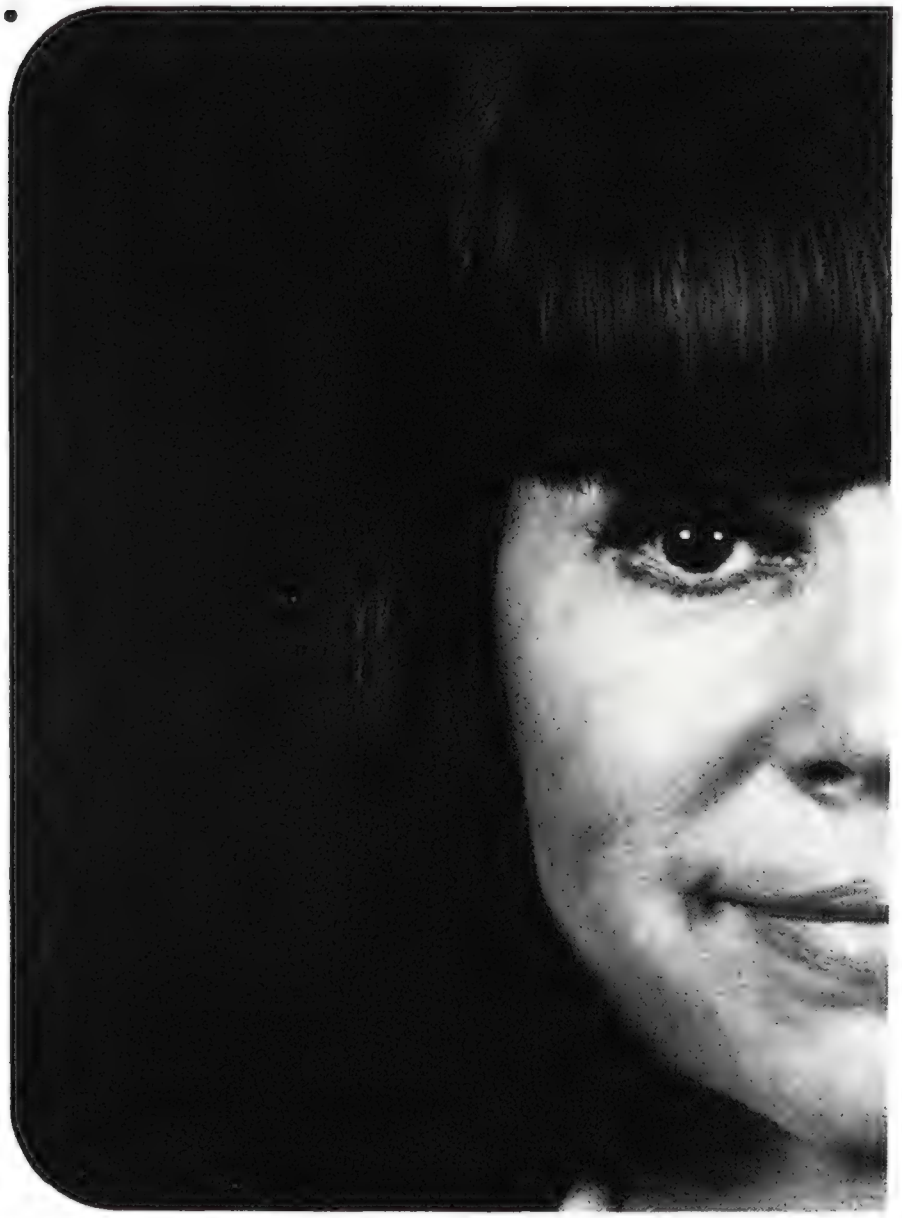

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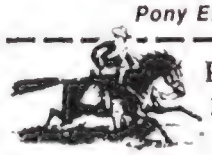

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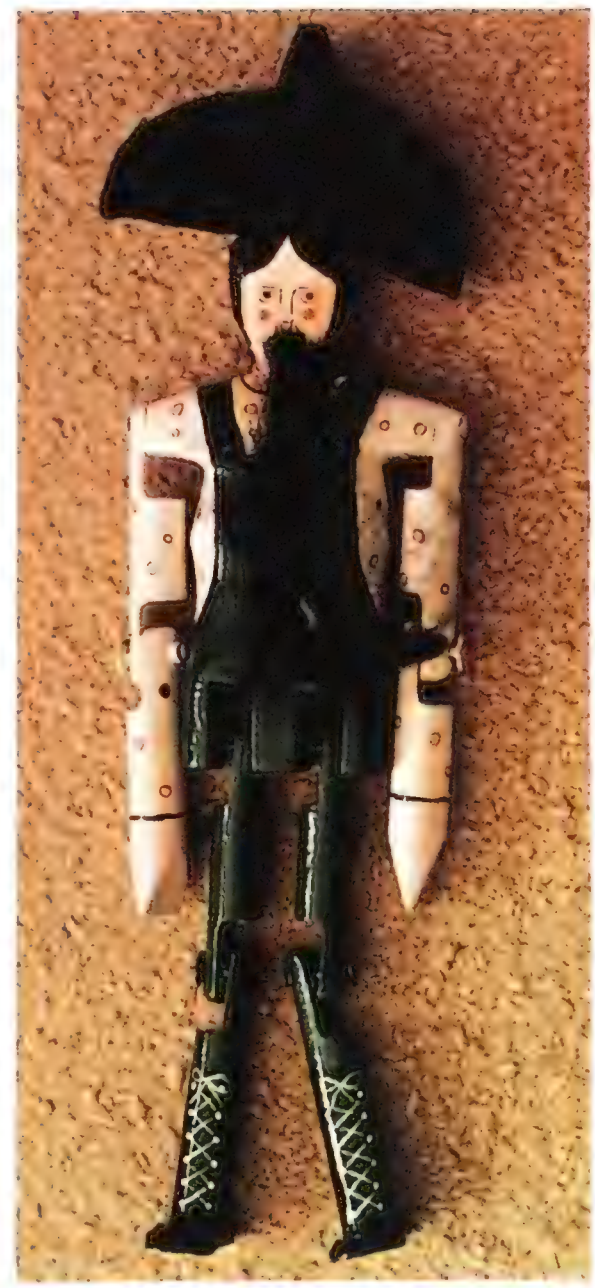
"show and tell" without something to glue it together. But to be Somebody—Joshua Hartman, preacher-teacher, or Hannah Abshire, farm wife—a person who might have lived in West Virginia in the 1860s, gave an opportunity to identify with the people of the past and to walk a mile in their moccasins, as the saying goes.

The roles were grouped into six family units. The ethnic background of West Virginians of that period was taken into account. Occupations, too, were prototypes of the period: lawyer-merchant, teacher-preacher (sometimes it took two professions to keep food on the table), doctor, miner, riverboat captain, farmer.

One of the favorite objects in the trunk is the mountain dulcimer. The drone of this ancient instrument—an Appalachian form of the zither—accompanies many a sing-along. It can be played reasonably well in a short time, and there are books of instruction and folk songs for the dulcimer as part of the resource material in the trunk. If a student "turns on" to the mountain dulcimer, it can become a lifelong hobby. There are patterns available for making your own, and artisans in every area are turning them out.

Nothing speaks more eloquently of the past than a quilt. In every trunk there is a quilting kit complete with fabric, backing, batting, thread, needles, a hoop and instructions for putting the blocks together. Boys and girls together love to quilt, and they often go on to bigger and better quilts from this start.

Traditional quilt patterns with folklore thrown in are documented in a filmstrip called *Patchwork,* contained in the trunks. We took camera and tape recorder —the tools of the modern historian—and went to Summers County where we photographed the women of the Big Creek Sewing Co-op at work on products for Mountain Artisans. Another group of quilts from Cabin Creek Quilts enhanced the film strip collection. Both of these industries nourish the new appetite for quilts and patchwork and at the same time provide work for crafts people. The trunk project has introduced patchwork to thousands of eighth-grade boys and girls—many of whom want to learn more about the old craft.



"Dancing man" stomper doll is traditional West Virginia toy.

This fan is a reproduction of a popular filigree ivory type.

Each trunk contains a woman's dress, a sunbonnet, a pair of pantaloons ("split bottom drawers," as they were called), a fan and a man's outfit. The clothes are reproductions, for genuine old clothing would be too fragile for the trying-on that is so essential. The authentic dresses that were offered to the project would not have fit today's eighth-grade girl.

Fashion prints, family portraits, photographs and daguerreotypes are all good resources for clothing study. A fashion print—several are from Godey's—is included in every trunk. The woman's dress

Neil Armstrong by Paul Calle

The National Air and Space Museum has produced a limited edition of 1000 high quality reproductions of Paul Calle's graphite pencil portrait of astronaut Neil A. Armstrong. This unique numbered edition measures 19″ x 29″ and is signed by both Calle and Armstrong.

Paul Calle was the only artist to be with the Apollo 11 crew as they prepared for flight at Cape Kennedy on July 16, 1969, the morning of their historic launch. NASA had asked artist Calle to document the activities of the Apollo 11 astronauts in the hours before their launch so that the record of this historic event would be as complete as possible. He agreed, though it meant adhering to strict quarantine procedures required of all having personal contact with the crew. The on-the-spot drawings produced by Calle are a documentary record of the final moments on Earth of three men before they made world history. Calle completed this assignment and the work was shown at the National Gallery of Art in Washington, DC, in November 1969, then displayed in the National Air and Space Museum. For the following two years, the Smithsonian Institution circulated these drawings to many galleries and museums around the nation. They are now part of the National Air and Space Museum's collection.

19″x 29″ "Apollo 11 Astronaut Neil A. Armstrong" by Paul Calle

This portrait reproduction shows Neil A. Armstrong four days before he became the first human being to set foot on another planet. Each numbered and signed art reproduction sells for one hundred twenty-five dollars. All profits from the sales will be donated to the *Charles A. Lindbergh Memorial Fund*, which has recently been established to provide fellowships and grants to deserving individuals in the areas of science which most interested Lindbergh, such as aeronautics, conservation, exploration, and wildlife preservation.

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Paul Calle and Neil Armstrong sign the prints at the National Air and Space Museum on December 23, 1976.

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is made either of calico or, more elaborately, of a taffetalike fabric. The calico is a work dress—the kind that a woman could dress up or down with a lace collar or a simple kerchief. The silk is a "second-day dress," worn by a bride the day after her wedding to call on her new relatives or to receive callers. It was the best she could afford, and she wore it proudly for years afterward.

The man's outfit is a pair of trousers, a coonskin cap and a wamus—the fringed jacket worn in earlier pioneer days on the Appalachian frontier. Although it was the height of fashion about 1840, it continued to be worn until about 1870. An authentic wamus would be made of hide—expensive and heavy. Men's clothing of the period can easily be simulated with string tie, vest, coat and trousers. A look at the political figures of the day tells us what we already know—that men's styles don't change as radically or as rapidly as women's do.

The puppet family originally designed to dramatize a tape on folk language and lore has worked its way into the hearts of the participants. Made of papier-mâché and cloth, the puppets include a bearded fellow whose appearance in checked workshirt can be altered to that of lawyer or legislator by adding a shirt front with string tie, black coat and stovepipe hat. A younger man puppet can be a turncoat at will with uniforms of both Confederate and Union soldiers. A woman puppet of uncertain age can change easily from calico to another costume.

Toys too have their story. They sometimes imitate a segment of adult life, and, when necessity dictated, they were made of the simplest materials at hand—wood, cloth, buttons, string. While some children undoubtedly had lovely bisque dolls from France and ingenious metal toys from Germany, we have concentrated on folk toys made of simple materials. These are made and marketed by West Virginia artisans, and there is plenty of evidence to substantiate their authenticity. The cornhusk doll, the dancing man or "stomper doll," puzzles and tops are all meant to be played with and used. They are expendable and replaceable.

Lest our artifact spectacles are too rose-colored, family letters that tell of hardships and death have been reproduced. It is a temptation to tell of the past romantically, so we must remember the words of the old codger who said, "Things ain't what they used to be, and they never was."

Reproductions of the McGuffey Readers and Noah Webster's *Spelling Book* can spark a schoolroom scene. A potpourri of papers and documents garnered from archives as well as private sources are props for the role play. Old land grants, a surgeon's leave of absence from a Civil War field hospital, a circuit-riding minister's license renewal, steamboat bills of lading—of boats that carried cheese, candles and gun ammunition—all give clues about the life of the day and what our ancestors were up to.

Genuine artifacts include spectacles, homemade soap and minié balls. You'd think the name of these small conical bullets had something to do with their size, but no. Found on Civil War battlegrounds, they were devised in 1849 by Claude Etienne Minié, an officer in the army of Napoleon III.

There's a sampler in every trunk that anyone can work on. Original antique samplers are pictured in a filmstrip that documents the development of the Heritage Trunk project, and young needleworkers are encouraged to stitch the one in the trunk or design their own. Handwoven cloth is there, too, with a book that tells about spinning and weaving. Or

With puppets from the trunks, children act out old-fashioned skits.

children can try an old-time recipe to serve at a class "sociable" with or without supermarket shortcuts.

Spelling bees, quilting parties, box suppers at a barn-raising, a sing-along, a meeting in the country store—all these are suggested in the printed teacher's guide to be undertaken within the framework of the role-playing families. Other ideas include gravestone rubbings, making apple butter and soapmaking. There are words of advice about observing the amenities of respect and courtesy if you go out to do a gravestone rubbing, and there are admonitions and cautions if one undertakes soapmaking.

Abby, Becky, Carrie, Dolly—and so on, with their coded feminine names—the trunks make the past come to life. History must tell a story. It's interesting that in French, Italian, Spanish, German—and perhaps many more languages—one word serves a dual purpose: *history* and *story* are the same word. So we must tell the story—not only of the West Virginia people of the 1860s but of later immigrants from central and southern Europe, of black Americans whose ancestors came in the bowels of ships, of Asian Americans who came at different times under different circumstances. The West Virginia Heritage Trunk is one way to tell it.

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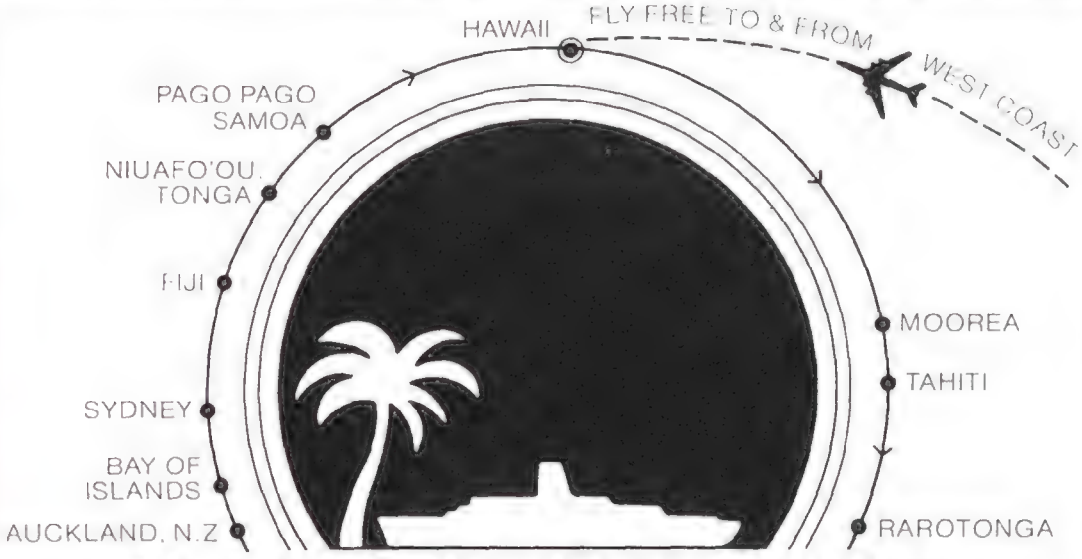

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Book reviews

The Restless Journey of James Agee
Geneviève Moreau; translated by Miriam Kleiger with the assistance of Morty Schiff (William Morrow, $10.95)

Last summer Ross Spears, a young Tennessean working on a film project on the life and thinking of James Agee, visited Jimmy Carter to talk about Agee. Carter had often mentioned that *Let Us Now Praise Famous Men* was his favorite book. Politicians often do the "favorite book" number, but Carter's assessment of Agee, as Mr. Spears recorded it, appeared to be authentic. "The life Agee wrote about in Alabama was the life I knew," Carter said on his Plains back porch. "We were not as poor as the Gudgers, but my neighbors were. A lot of the things described there—the fields, the chores, the churning of milk, the devastating hopelessness about life—were part of my early life. Agee's detailed descriptions of the most specific occurrences and observations, and his projections onto a universal scale of the suffering of people who were afflicted by poverty really touched my heart. . . . The worth of human beings is the thing that comes across in Agee's work."

We are not about to have a James Agee boom merely because his work is suddenly valued in high places. But the President's comments come at a moment when the public and Agee's mystique are well served by a careful and resourceful biographer, Geneviève Moreau.

The difficulty of examining Agee some 20 years after his premature death—he was 45—is that even while living Agee moved through the mist of legend. He was a journalist for Henry R. Luce who could research a story by living among the sharecroppers of rural Alabama. He embraced the glamours of Hollywood as a screenwriter and as a friend of Charlie Chaplin and John Huston. He preserved part of himself for the mystical realities of life, sustaining an enduring friendship with an Episcopal priest who was his boyhood mentor. His novel, *A Death in the Family,* is a lyrical saga of family relationships that is a classic in American literature. His film criticism is still read and studied, even by those who may never see the films of which Agee wrote. In his personal life, he endured the batterings of depression and failed marriages, and made few decisions without subjecting them first to what a friend called "his sometimes paralyzing conscience." He drank and smoked to excess, and would keep his friends up all night to talk.

Mme Moreau, a French scholar who lives in Paris, notes that for those who did not know him closely, "Agee had become one of the prototypes of the American intellectual artist. . . . If the generation of the thirties had found its reflection in Fitzgerald, Agee's generation recognized itself in that anti-intellectual poet, musician, journalist, screenwriter. He shared its uncertainties and its enthusiasms, its hatreds and its aspirations. For many, Agee embodied a magnificent dream, intensely pursued, but never realized: the dream of a world from which all sterility would be banished."

Like a ferryman, Agee moved between the shores of his life in New York and California and the one in his east Tennessee past. But all of it was one journey because it involved but one integrity. "I know I am making the choice most dangerous to an artist, in valuing life above art," he wrote. After his death, Mme Moreau writes, "people seized upon the myth that he himself had helped to create. His untimely death which left his work uncompleted lent him a new prestige; it seemed a paradoxical fate for a man who had been his own destruction. . . . Agee's life was seen as an exemplary failure . . . he had been a captive genius, the victim of a society that paid him well but robbed him of the circumstances favorable to truly creative activity and the will to pursue it."

In producing the first analytical biography of James Agee, the author wisely limited herself to the "inner adventure" of her subject's life—trying to reconstruct

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Other works of Arnold Machin include cameo portraits of most of the Royal Family for Wedgwood, portraits of Her Majesty Queen Elizabeth for the coins of the United Kingdom, Guernsey, the Bahamas and for the stamps of the British Postal Service. Mr. Machin is past Master of Sculpture at the Royal Academy Schools and Head of the Stoke School of Art. He is currently a member of the government committee for assessing colleges of art in the United Kingdom.

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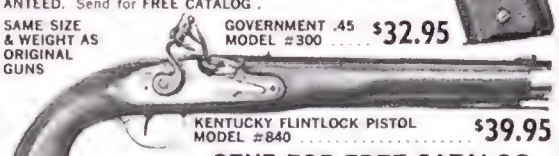

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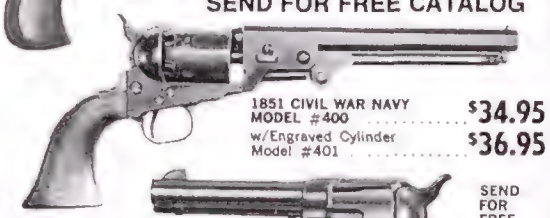

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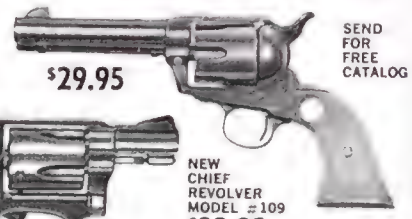

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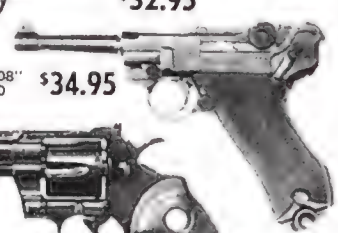

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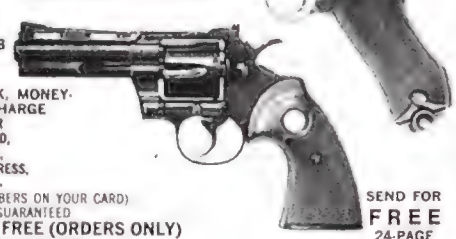

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it and follow the parallel developments of Agee's creative work and his fidelity to his values. Agee could not have been an easy study. As she writes: "Introspective by nature and by taste, almost unhealthily subjective, accustomed since childhood to the examination of conscience, Agee left behind numerous self-analyses—portraits or confessions that were both complacent and pitiless—thereby contributing to the creation of his own myth." Mme Moreau, avoiding the stance of the myth exploder, chooses the more difficult way of investigating whether the myth was a means of self-deception for Agee or was merely the standard emotional baggage with which everyone travels. Who doesn't create a myth about himself, or wish he could if someone was available to swallow it?

If the books of James Agee deserve our attention, then this perceptive and reasoning biography is as reliable a compass as we have in directing us to further study. No biographer ever fully succeeds in explaining the interior functioning of a subject, and Geneviève Moreau is no exception. But she has done well here, as sensitive to the flows and pressures of Agee's life as to the power of his writing.
—Colman McCarthy
Washington Post staff writer, and author, most recently, of the book *The Pleasures of the Game*

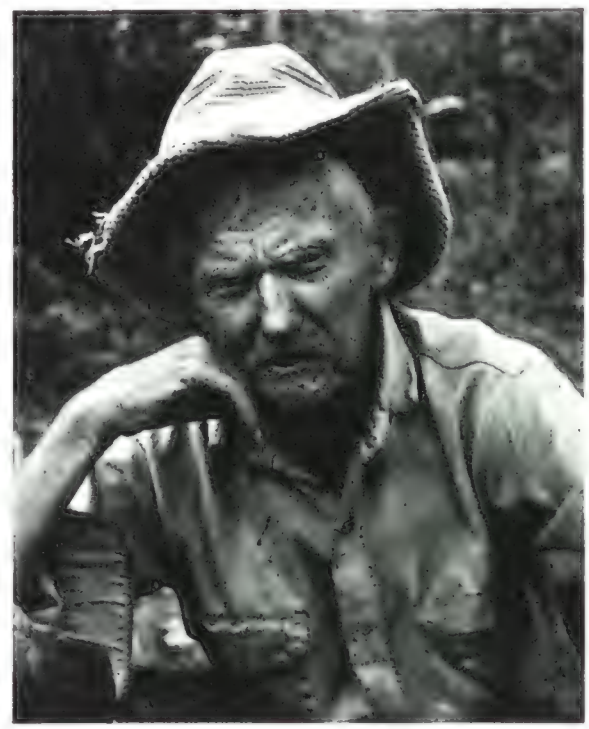
Big Thicket Legacy
Compiled and edited by Campbell and Lynn Loughmiller
(University of Texas Press, $12.95)

If the reader of this book will surrender to the spell of "a well of native English undefiled," he can experience the living color, sound, cadence and content of a special corner of relatively unspoiled American country, with its human and animal denizens.

In *Big Thicket Legacy,* Campbell and Lynn Loughmiller, a husband-wife team noted in the Southwest as specialists in organizing camps for boys, present the fruits of their principal hobby—a decade of recorded conversations with old settlers. The thicket which is central to this volume is almost a wilderness, covering about 300,000 acres in several counties of deep East Texas. The area has retained its character for more than a century, despite wars, depressions, oil booms and lumbering. It is of interest to biologists, ecologists, recreationists and students of human nature—it has been proposed as a national park.

Professor Francis E. Abernethy, executive secretary of the Texas Folklore Society, sets the stage in an insightful foreword. "Few books," he says, "are able to catch the spirit as well as the sound of a place, especially when that place has as strong an identity and personality as the Big Thicket has. But Campbell and Lynn Loughmiller have, and they have been able to catch the speech patterns and figures and rhythms without resorting to cracker-barrel dialect writing."

Most of the two dozen sections of the book are built around the reminiscences of particular characters, typically 80 or 90 years of age—about their families, adventures, ways of making a living, amusements and outlook on life.



Brunce Jordan, Big Thicket resident

This structure allows a natural flow of talk. For instance, Lance Rosier, a favorite of the Loughmillers, says: "I was born in a house down here south of town, and have lived all my life right here in Saratoga. My grandfather, Tom Jordan, settled here during the Civil War. There was all kinds of food in the Thicket, all kinds of animals and fish for meat: worlds of wild hogs. . . ." Then he describes the flowers, trees and swamps. He tells about Little Richard, "a crow who thought he was a dog," and of a friend who "went out to Ebbie Cotton's one day, about two miles from here, and he come back and

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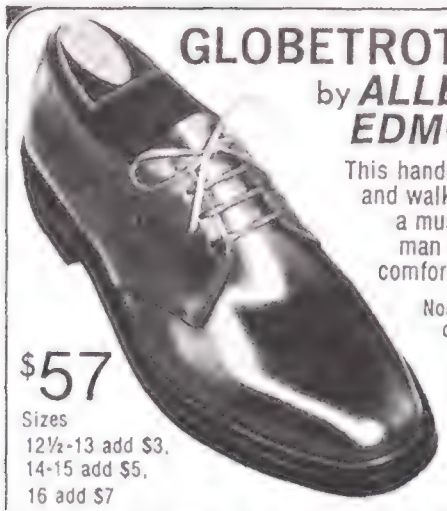

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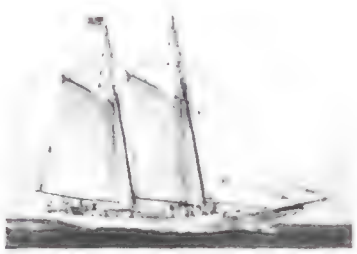

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Pope-Leighey House, designed by Frank Lloyd Wright, on U.S. Route 1 in Mount Vernon, Va.

said that Little Richard stayed out there all day long with his dogs, and he went hog hunting with Mr. Cotton. Every morning when they'd start out, why Little Richard would go out with them. And when the dogs would get to where there was a bunch of hogs, why Little Richard would get down on the ground and bark just like a dog. If a hog started after one of the dogs, why he'd get on his back and pull a mouthful of hairs out. And he'd just run the old hog crazy, because he couldn't do nothing about it."

Quotable passages abound. Aunt Ell recalls: "When one of us get kinda puney, why daddy would fix us up some old rusty nails in water and make us drink it; gave us iron." She also reports: "I was at a log-rollin' one time and just before dinner two of the boys got in a fight over a girl and one knocked the other in the head with a hand spike and killed him just as dead as a doornail, right there in the field. He was drunk, how come him to do it. Made their liquor out of peaches and apples and corn."

The book is a storehouse of history, down-to-earth information, good humor, leg-pulling spoofs, tall tales and all kinds of serendipitous gems. Its successful use of recording devices and techniques, reinforced by responsible, sympathetic editing, cannot fail to inspire regret over the passing of so many American pioneers whose stories went unrecorded. It also invites comparison with such excellent but rather stilted efforts as the two-volume works of the 1920s by John Marvin Hunter, entitled *Trail Drivers of Texas; Interesting Sketches of Early Cowboys and Their Experiences on the Range and on the Trail. . . .*

Readers inclined to fantasy might like to think of two giant Texas folklorists of the past, J. Frank Dobie and Mody Boatright, nodding and winking their approval of *Big Thicket Legacy*.

—Earl B. Braly
Former Professor of English
at Texas Tech University

The Papers of Frederick Law Olmsted: Volume 1: The Formative Years, 1822-1852, Edited by Charles Capen McLaughlin (Johns Hopkins University Press, $20)

Frederick Law Olmsted (1822-1903) is one of the giants of American civilization, the founder of the profession of landscape architecture and a major contributor to modern theories of urban planning, as well as an early supporter of a national park system.

Olmsted is remembered primarily as the landscape architect (he was the first to use the term) of Central Park in New York and Prospect Park in Brooklyn, of parks, landscapes and plans for a score of American subdivisions, as well as the grounds of the U.S. Capitol and a number of universities—but his influence extended far beyond design on the land. He considered one of his greatest public services his work as Executive Secretary of the Sanitary Commission during the Civil War, where he devoted his efforts to protecting the health of the Union Army, and later to initiating efforts to improve sanitary conditions in cities.

Olmsted was also a perceptive observer and social commentator, and a prolific writer. His avowed goal to "advance civilization" by extending education about scientific farming and other fields led him into a variety of publishing ventures, which included a number of books based on travel experiences. In 1852-53 he explored the American South as a roving reporter for the *New-York Daily Times*. The three books that resulted from this and a later visit remain among the most objective studies of the slave economy of the antebellum South.

This gathering of his papers is the first of a projected eight-volume series that will make available in fully annotated form the best of Olmsted's letters, unpublished writings, and newspaper and periodical articles. Six of the forthcoming books will continue the chronological treatment of selected Olmsted documents, while one will deal directly with his writings on landscape design. Sponsored by American University and funded by various public agencies and private foundations, the books will draw upon thousands of Olmsted items in the Library of Congress and elsewhere. The result of 27 years of research, this first volume is a model of scholarly editing. It is also a fascinating work to read.

While it does not cover the better-known aspects of Olmsted's career, it does illuminate the events of his early life and offers insight into his intellectual development. It includes all the extant letters that Olmsted wrote during a voyage to China in 1843-44 and on a trip to Eng-

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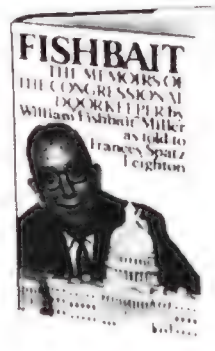

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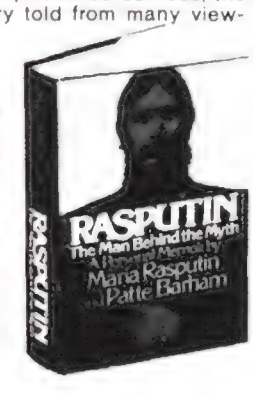

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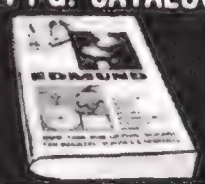

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land in 1850, which already show the "eye for significant detail" that would appear in his later books. As a complement to publications about Olmsted already in print, they add a private, unguarded and fascinating dimension.

These early letters reveal the development of Olmsted's attitudes toward nature and the land which he had gained as a farmer, as well as his own spiritual growth, especially in regard to religion. By wide reading and his efforts at model farming in Connecticut and on Staten Island, he acquired, he said, "a great many independent and agrarian and revolutionary ideas and ways of thinking" and also his never-to-be-altered conviction that, according to McLaughlin, "farming combined the proudest aims of science and fostered the development of man's esthetic sensibilities." As a growing belief in the redemptive power of nature challenged the religious doctrines of his 19th-century New England upbringing, he determined "not to join a church which required anything more than Christ and the Apostles did."

The Papers of Frederick Law Olmsted is a major contribution to American letters, an important step in the documentation of this American genius.

—*William Morgan*
Associate Professor of Fine Arts
University of Louisville

The Collapsing Universe
Isaac Asimov
(Walker and Company, $8.95)

The prolific Dr. Asimov, that one-man publisher's list, has done it again; this time about gravity. The subject is the collapsed object and, particularly, the ultimate collapsed object, the black hole —and the one overriding property of the black hole is its incredible gravity, gravity so strong that even a photon of light cannot escape its surface.

In order to appreciate how nature can create such superdense objects, a certain amount of background on the gravitational force is necessary. Asimov develops this nicely, although the pathway is not a straight one, or, at least, may not appear so to the lay reader. Early chapters deal with the planets of our solar system, their density, interior composition and how the electromagnetic forces of molecular bonds resist the enormous compression

by gravity. It is now only a short step from planetary interiors to the formation of stars. As the author points out, Jupiter need be only a little more massive, and nuclear ignition would begin in the Jovian core—creating a new star.

All this may seem something of a digression, but actually it is a foundation for the gravitational wonders to come. The normal evolution of a small star leads us to the first collapsed object: the white dwarf star. Black holes may be nothing more than a theoretical physicist's dream—or nightmare—but the white dwarf star was once such a figment whose existence has been established beyond question. White dwarf densities exceed one ton per cubic inch. If you can live with something that preposterous, what's another dozen orders of magnitude?

Larger stars are given to a more violent end, leading to the production of novas or supernovas. The latter can result in the creation of an even denser collapsed object: the neutron star. Neutron stars have been crushed by gravity to nuclear dimensions resulting in a density perhaps one billion times that of the white dwarf! These bizarre objects are thought to be pulsars which have been observed within the Milky Way Galaxy.

At this point, Asimov can take us into the ultimate collapsed object—the black hole—that cosmic vacuum cleaner from which there is no escape. There is a lively discussion of black hole properties and possible means of their detection. (How, after all, do you find something you can't see?) In his closing chapter, Asimov dons his science-fiction writer's hat and indulges in some fanciful—but informed—speculation on the future of the universe: its possible collapse, quasars as "white holes," space-time "wormholes," and ultimate recycling of the universe.

I find Asimov's writing very good for the layman. He explains without condescending, uses analogy well, avoids heavy arithmetic. The book is not illustrated, a significant omission, as an occasional sketch would have enlivened the text and aided conceptualization. *The Collapsing Universe* is both full of facts and fun to read. Be forewarned: black holes are replacing extraterrestrial life as the No. 1 topic at cocktail parties.

—Dale F. Dickinson
Center for Astrophysics,
Cambridge, Massachusetts

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Pay parking available at the National Air and Space Museum, 7th St. and Independence Ave. And to assist in planning your visit, orientation services are provided in the Castle from 10:00 a.m. to 4:00 p.m.

We'll look forward to seeing you. Please keep this announcement for reference.

The Associates Court

Additional reading

Desert sands (p. 34)

"Arid Lands in Transition" by H. E. Dregne, Publication #90 of the American Association for the Advancement of Science, 1970

Losing Ground: Environmental Stress and World Food Prospects by Erik P. Eckholm, W. W. Norton & Company, Inc., 1976

The Physics of Blown Sand and Desert Dunes by R. A. Bagnold, William Morrow & Company, Inc., 1941

Thracian treasures (p. 42)

"Thracian Treasures from Bulgaria," *The Bulletin,* Metropolitan Museum of Art, Summer 1977

Bulgaria's Treasures from the Past by Ivan Venedikov, Foreign Languages Press (Sofia), 1965

Bulgaria in Antiquity: An Archaeological Introduction by R. F. Hoddinott, St. Martin's Press, 1975

Recombinant DNA (p. 54)

Molecular Biology of the Gene by James D. Watson, W. A. Benjamin, Inc. (Menlo Park, California), 1970

"Plasmid—Welcome to the Word Pool. But What Are You?" by Janet Hopson Weinberg, *Science News,* June 21, 1975

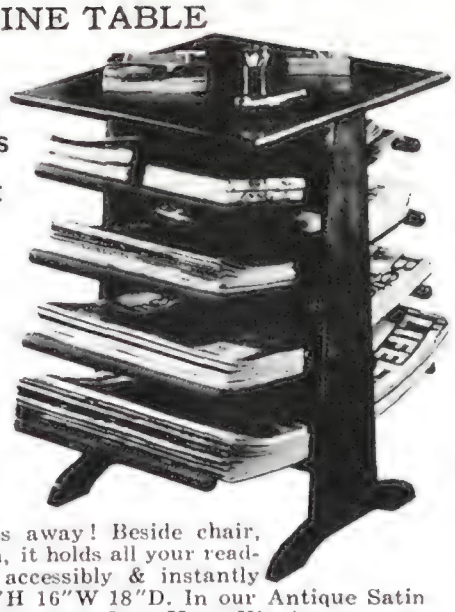
"The Manipulation of Genes" by Stanley N. Cohen, *Scientific American,* July 1975

"Science that Frightens Scientists: The great debate over DNA" by William Bennett and Joel Gurin, *Atlantic Monthly,* February 1977

National Theatre (p. 66)

"The National Theatre, A Special

MAGAZINE TABLE



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Issue," edited by Colin Amery, *The Architectural Review* (London), January 1977

The Theatres of London by Raymond Mander and Joe Mitcheson, Rupert Hart Davis (London), 1963

Nautilus (p. 76)

"Living Nautilus" by H. B. Stenzel, *Treatise on Invertebrate Paleontology* (Part K), edited by Raymond C. Moore, The Geological Society of America and the University of Kansas Press, 1964

"Life and Its Environment in Ancient Seas" by Anna M. Bidder, *Nature*, December 1961

The Burke Collection (p. 84)

Japanese Art: Selections from the Mary and Jackson Burke Collection, The Metropolitan Museum of Art, 1975

Traditions of Japanese Art: Selections from the Kimiko and John Powers Collection by John M. Rosenfield and Shujiro Shimada, Fogg Art Museum, Harvard University, 1970

Trustees of Reservations (p. 92)

The Use of Land: A Citizen's Policy Guide to Urban Growth, edited by William K. Reilly, Thomas Y. Crowell Company, Inc., 1973

The Last Landscape by William H. Whyte jr., Doubleday & Company, Inc., 1968

Perfect likenesses (p. 100)

Perfect Likenesses, National Museum of History and Technology, 1977 (catalog of the exhibition)

Thomas L. McKenney, Architect of America's Early Indian Policy: 1816-1830 by Herman J. Viola, The Swallow Press, Inc. (Chicago), 1974

The Indian Legacy of Charles Bird King by Herman J. Viola, Smithsonian Institution Press and Doubleday & Company, Inc., 1976

West Virginia trunks (p. 106)

The Allegheny Frontier, West Virginia Beginnings 1730-1830 by Otis K. Rice, University of Kentucky Press, 1970

The Young Mrs. Blennerhassett by Nellie Whan Peppers, Exposition Press, 1964

American Folk Toys by Dick Schnacke, G. P. Putnam's Sons, 1973

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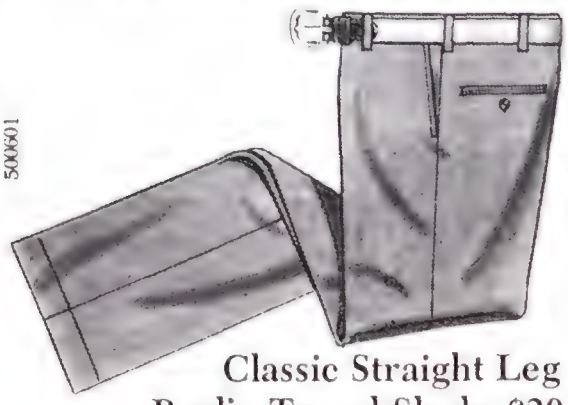

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Smithsonian highlights

Summertime is children's time, and there are a number of special treats for them—and their elders—this year. Among them:

On the Mall
"Washington Merry-Go-Round," the 55-year-old carousel outside the Arts and Industries Building, will carry children of all ages on its two chariots and 33 animals, including Winkie and other horses, pigs, dogs and fowl, to the accompaniment of its original Wurlitzer band organ. Daily except on Monday, from 10 A.M. to 5 P.M.

Chesapeake Bay Center for Environmental Studies
"Summer Ecology Program," for children living in nearby communities, will be held from June 28-August 12. For information write to C.B.C.E.S., Route 4, Box 622, Edgewater, Maryland 21037 or phone 301-798-4424.

Resident Associates Program
"Many Happy Returns," the fourth annual boomerang festival, will award trophies for accuracy in throwing and catching. Open to the public, but children nine years of age and younger must be accompanied by a parent. West Potomac Park, June 11. Registration at 3 P.M., competition at 4 P.M.

National Zoo
New trails down which visitors may stalk ducks, crown cranes, polar bears, zebras and elephants to the creatures' lairs, via colored footprints, open June 14.
Note: panda feeding times are now 9 A.M. and 3 P.M.

Cooper-Hewitt Museum
"Andrea Palladio." Large-scale models show 16 villas and churches designed by this brilliant and influential 16th-century Italian architect. There are contemporary drawings and books, as well as photographs. June 7-September 11.

Freer Gallery of Art
"Oriental Calligraphy" includes fine examples of all five major written Chinese scripts and Japanese, Near Eastern and early Christian artifacts, dating from A.D. 531. Twenty rubbings of ancient Chinese stelae are being exhibited for the first time. On view all summer.

Air and Space Museum
A special TVphone, by which deaf visitors and callers with TVphones can talk with the staff, has been installed at the information desk. Answers to questions will appear on a TV screen. To use, dial (202) 381-4244 or stop at the museum's information desk between 10 A.M. and 4 P.M. "My Time Is Your Time" is the new sky lecture in the Albert Einstein Spacearium. For tickets, call (202) 381-4193 weekdays. Saturday from 9-10 A.M., June 18 through July 9.

Museum of History and Technology
"The Cowing House," a prairie example of the 19th-century balloon-frame construction technique which, from its inception in Chicago in the 1830s, revolutionized home building in America, is part of the permanent exhibition.

Independence Day will be celebrated on the Mall and terraces around the museum with music and other frivolity. July 2, 3 and 4. For details, call (202) 381-6264.

Renwick Gallery
"Iron, Solid Wrought/USA," celebrating the blacksmith as an artist and craftsman, contains 100 objects, from historical works to contemporary creations. June 10-October 24.

"Recent Works in Metal by Albert Paley," includes his award-winning wrought-iron gates for the Renwick's shop as well as gold, silver and tin objects. June 10-October 24.

Division of Performing Arts and Musical Instruments
"Fletcher Henderson: Developing an

American Orchestra, 1923-1937" and "Teddy Wilson: Statements and Improvisations, 1934-1942," are the newest recordings on the Smithsonian Institution label. $9 ($8 to Associates) and $6.50 ($5.50), respectively. Available at all museum shops or by mail, with a check payable to Smithsonian Institution, P.O. Box 1641, Washington, D.C. 20013.

Smithsonian Institution
Traveling Exhibition Service

SITES sends outstanding examples of the Smithsonian's own collection and that of other museums throughout North America. To find out how to bring an exhibit to your area, write: Smithsonian Institution Traveling Exhibition Service, Washington, D.C. 20560. Some current shows:

- El Paso, Texas—"Folk Woodcuts from Brazil's Northeast," and "America's First Ladies," El Paso Museum of Art, June 4-July 3, and June 18-July 17, respectively.
- Jackson, Mississippi—"And the Band Played On" celebrates the history of America's bands—military, concert and jazz—through two centuries. State Historical Museum, June 11-July 10.
- Riverside, California and Newport News, Virginia—"Black Women: Achievement Against the Odds," Sierra Middle School and AKA Sorority, respectively, May 8-June 26.
- Ames, Iowa—"Delacroix and the French Romantic Print," Iowa State University, May 7-June 5.
- Scottsdale, Arizona—"Locks from Iran: Pre-Islamic to Twentieth Century," Center for the Arts, May 24-June 26.
- Roxbury, Massachusetts—"The Frederick Douglass Years," Museum of Afro-American History, June 18-July 17.
- Santa Ana, California — "Tunisian Mosaics" depicts worship of the gods and events of daily life from Roman, Vandal and Byzantine times. Charles W. Bowers Memorial Museum, May 14-June 19.
- Edmonton, Alberta—"Toys from Switzerland" is a history of children's playthings—primitive, handmade by artisans and mass-produced. Provincial Museum of Alberta, June 11- September 25.

When Associates visit Washington

Upon arrival at the Smithsonian, members are invited to register at the Associates Reception Desk in the Smithsonian castle on the Mall. Here, from 10 A.M. to 4 P.M. daily, special orientation materials may be obtained from a staff prepared to

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Travel Benefits for Smithsonian Associates

With the growth of the Smithsonian Associates, the Institution is striving to meet the needs of its membership by offering a varied travel program. Traditionally, Foreign Study Tours provided culturally oriented, first-class, specialized trips under the guidance of museum curators or experts in respective fields. Then, Domestic Study Tours were added to offer similar opportunities within the United States, thus allowing Associates and their families a chance to combine vacation with a period of study. Two years ago, Foreign Charter Tours were introduced; these trips are larger, lower-cost and more generalized in nature. Associates travel benefits are announced exclusively in SMITHSONIAN. Write addresses below for additional information.

Foreign Study Tours

Baltic, Norway and the Fjords—July 30-August 18: Cruise on the *Argonaut* to Sweden, Estonia, Russia (Leningrad), Finland; spend a week in the fjords of Norway • **The Isles of Britain**—August 19-September 3: Cruise aboard the *Argonaut* from Edinburgh at Festival time to the Orkney, Hebrides and Scilly islands, Northumbria, northern Scotland, Wales • **Peru, Ecuador and Colombia**—September 27-October 19: Art and archaeology. Dr. Elizabeth Benson of Dumbarton Oaks, guest lecturer • Write Miss Bliss Schumann, Foreign Study Tours, SI 123, Smithsonian Institution, Washington, D.C. 20560 or call (202) 381-5520.

Foreign Charter Tours

English Countryside Excursions*—July 25-August 8: The best of London museums and theater, plus a choice of specially designed four-day excursions to East Anglia and Cambridge, great houses and gardens, archaeological sites, cathedrals, literary England or Pilgrims' Way • **Russia***—October 3-17: The Bolshoi, Moscow Circus, Hermitage; schools, factories and housing in Moscow, Leningrad and Tallinn • **Sultans' Treasures***—October 10-24: An adventure tour to Istanbul and Asiatic Turkey featuring the royal treasury and collections at Topkapi Palace, the Blue Mosque, an evening in a Turkish home and a cruise on the Bosporus. Select an excursion to Aegean Turkey, including Troy and Pergamum, an important Greek and Roman city near Ephesus; or central Anatolia and Cappadocia with its exciting rugged landscape, old caravansary and the unbelievable valley of underground houses and churches that was the center of the Byzantine anchorite movement • **Mexico City and Yucatan**—November 4-15 or November 19-30: A study program in Mexico City concentrating on Aztec and Toltec cultures; visits to the Mayan ruins of Chichén-Itzá, Uxmal and Palenque (originates in Mexico City) • Low cost of tours includes first-class hotels, most meals, sightseeing, lectures, theater tickets and air fare. Foreign tours are heavily subscribed, so for additional details concerning a specific trip write early to Smithsonian Associates Travel Program, A&I 1270B, Smithsonian Institution, Washington, D. C. 20560, or call (202) 381-5635 for information.*Optional pre-departure course will be available.

Domestic Study Tours

Yosemite High Country—June 4-13: From towering waterfalls to soaring granite spires and giant sequoias, Yosemite offers rare beauty and grandeur. Visit both the Valley and the lesser known areas of the park under the guidance of Yosemite Institute staff • **Wind River Mountains**—July 30-August 7: A horseback trip into the land of the mountain men; camping at an altitude of 10,000 feet in the midst of turquoise lakes and high-meadow wild flowers • **Desolation and Gray Canyons**—July 27-August 3 or September 30-October 10: A white-water trip for the adventurous; explore the geology, wildlife, and Indian and outlaw history of Utah's Green River • **Connecticut Antiques**—August 21-28: Learn about 17th- and 18th-century architecture and decorative arts with visits to historic sites, restored homes and antique collections from New Haven to the Berkshires • **Nantucket and Newport**—September 24-October 3: Enjoy the colors of fall and the uncrowded towns on Cape Cod, Martha's Vineyard, Nantucket and Newport for a look at the life and homes of the 18th and 19th centuries • **Mesa Verde and Chaco Canyon**—September 24-October 2: Enjoy autumn colors in the Southwest while learning about the history of the Pueblo Indians through in-depth visits to these important archaeological sites as well as the beautiful Canyon de Chelly, Arizona • **Oregon: End of the Trail**—September 10-20: Explore the natural beauty of the Northwest with hikes around Mt. Hood, Crater Lake and Redwood National Park. Also a jetboat ride up the Rogue River and the Ashland Shakespeare Festival • **Dories on the Salmon**—September 10-25: Oar-powered wooden dories provide unique transportation through the wild, spacious, majestic country of the Salmon River in Idaho • **California Wine Country**—October 2-8: Learn about California wines with lectures and wine tasting at selected vineyards in Napa, Sonoma, Santa Clara and Monterey • **Archaeological Dig**—October 15-22: Join archaeologists in the excavation of an Illinois River Valley site spanning almost 10,000 years. Actual digging will be supplemented by instruction, lectures, laboratory work and field trips • **Antebellum Homes of Alabama**—October 24-November 1: In 1850 Alabama's plantation owners were the leading cotton producers of the country. They lived in a grand manner that has become legendary. Under auspices of local historical societies, we will learn about the history and traditions of this "golden era" • **Also in October** there will be a special weekend for the blind at the new National Air and Space Museum • **Washington "Anytime" Weekend**—Visit the nation's capital and tour the original Smithsonian building. Spend two nights at Lowe's L'Enfant Plaza Hotel (reservations required ten days prior to weekend) • Write Associates Travel Program, A&I 1270B, Smithsonian Institution, Washington, D. C. 20560 or call (202) 381-5635 for details.

assist you. A lounge area also is located in this building.

Breakfast (see p. 122), luncheon and dinner are available to Associates daily in The Court, the members' dining room in the Museum of Natural History.

Associates planning a trip to the Smithsonian may send a postcard or call for an information packet: Associates Reception Center, Smithsonian Institution, Washington, D.C. 20560; call (202) 381-6264.

If you have misplaced your membership card, the Associate receptionist in the castle will issue a replacement upon presentation of your SMITHSONIAN magazine address label. Membership cards are required for dining in The Court and for discounts in the museum shops.

Regional Program invites 1977-78 cosponsors

Regional activities of the National Associate Program in 1976-77 included exhibits, lectures, educational workshops and performing arts events in Peoria, Milwaukee, Detroit, Seattle, Portland, Denver and Minneapolis-St. Paul. Museums and cultural and scientific organizations interested in cosponsoring regional programs for 1977-78 may write: R. H. Angle, Smithsonian National Associate Program, Room 1201, 900 Jefferson Drive, Washington, D.C. 20560.

Spring Museum Hours

Most museums on the Mall—Arts and Industries, Hirshhorn, Air and Space, Natural History, History and Technology, and the Smithsonian castle—are open daily 10 A.M. to 9 P.M. The Freer, National Collection of Fine Arts, National Portrait gallery and Renwick close at 5:30 P.M. The Zoo buildings are open daily 9 A.M. to 6:30 P.M., Zoo grounds from 9 A.M. to 8 P.M., and the Anacostia Neighborhood Museum 10 A.M. to 6 P.M. weekdays and 1 P.M. to 6 P.M. weekends. For information call (202) 381-6264.

Parking for Visitors

Street parking near the Smithsonian complex is difficult. Use of public transportation is recommended. The Air and Space garage, 7th Street and Independence Avenue, S.W., is open daily from 7 A.M. to 10 P.M. Recreational vehicles higher than seven feet are prohibited from garage parking.

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By Erma Bombeck

Boston Straggler is a tour type not to be missed

Don't misunderstand me.

Some of our most wonderful moments have been spent on guided travel tours throughout the world, but it continues to be a source of amazement how the same people seem to follow our footsteps on every one of them.

No matter where our point of embarkation is, they are always there . . . all lined up with their name tags over their left bosoms, cameras hung round their necks, ready for another forgettable adventure.

There's Kaopectate Carrie. Ignoring national monuments, historic castles, art treasures and miracles of nature, she dedicates the trip to keeping a log of the bodily functions of the whole tour group.

Beginning at breakfast, she takes a poll of those who are "irregular," taking great pains to report who went from Column A to Column B during the night.

Then there's Jack The Tipper. Jack knows that the only way to get attention is to pay for it. He always travels with a quarter up his fingernail. As soon as he is seated, he will summon the waiter and say, "My name is Jack. What's yours?" Given the name, he will smile and say, "Leroy, do you know what vodka is?" (Leroy nods enthusiastically like he has just won a big door prize.) "We're going to get along just fine," says Jack, flipping him another quarter.

Every tour has the Boston Straggler. If the tour stopped for half a day to view bird-do on a statue, the Boston Straggler would be the last one on the bus/train/plane/boat/ferry/monorail/cart/subway/elevator or, as the case may be, lift. As the entire group sits on the bus watching their fingernails grow, the Boston Straggler bounces aboard, panting, "Are you all waiting for *me*?"

The Brag Bag never misses a trip. No matter what your accommodations, she will trill, "Didn't anyone else get the room with the balcony and the fireplace? Oh, maybe I shouldn't have mentioned it." Or, "You paid 40 American dollars for that bracelet? I got four of them exactly like yours for $3 each." I always have the feeling if I had met the Pope, the Brag Bag would have gasped, "You didn't meet his boss?"

Naturally, there's Yankee Doodle Dandy, who could start a war over a bad cup of coffee. He complains that the street signs in France are printed in French, the animals in Africa should be put in cages before they bite someone, and there's not one VFW in Switzerland.

And who has not traveled with Bored Ralph? Ralph's entire life is a rerun. He's been everywhere and done everything and will not sleep as long as you still have a speck of excitement left.

"You've never seen the Blarney Stone before?" he asks incredulously. "It's a shame you couldn't have seen it ten years ago before it became tacky." Or, "You're going to get off the bus in London?" he yawns. "I suppose if you've never seen it before it might impress you. How sad you're going to miss Venice. Now there's a city worth seeing. Did I tell you about Vittorio, the amusing innkeeper who always held the garlic on my fettucine?"

Ralph was the type who would call up a friend seeing *Citizen Kane* for the first time and say, "'Rosebud' is the sled."

And of course, what's a trip without Sweet Mrs. (fill in your own name) who is doing her Last Tango number? She was widowed 20 years ago and figures every trip is her last one. Her motto for living: "You only go around once in this life and you might as well do it with 38 pieces of luggage."

She also lives by another Golden Rule: NEVER BUY ANY SOUVENIR THAT YOU CAN PACK IN A SUITCASE.

What has this got to do with the rest of the tour, you might ask? A tour group is like a family. When one member of the family carries a marble-topped coffee table on her lap over East Africa, the rest of us have to pitch in to carry the authentic Masai spear and shield, the 9-by-12 Indian rug, the stuffed elk's head, and the dear little boulder that would enhance her patio and remind her of the trip. (The rest of us don't need a reminder. The hernia repairs will suffice.)

Last summer we went to Hawaii, and they were all there. At least I thought they were until I heard Kaopectate Carrie yell to the Brag Bag, "Is that other couple here yet?"

"Which ones?" she yelled back.

"You know . . . Mr. Wonderful, the guy who is the perfect tourist, and his wife, the Poison Pen, who sits there and takes down everything we say."

I wonder who *they* are.

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The look and feel of a sports car... the long-lasting practicality of a Mercedes-Benz. The 280E, the Practical Sports Sedan.

Here's a Mercedes-Benz that mates the practicality of a 5-passenger sedan with the nimble handling of a sports car. The 280E. The Practical Sports Sedan.

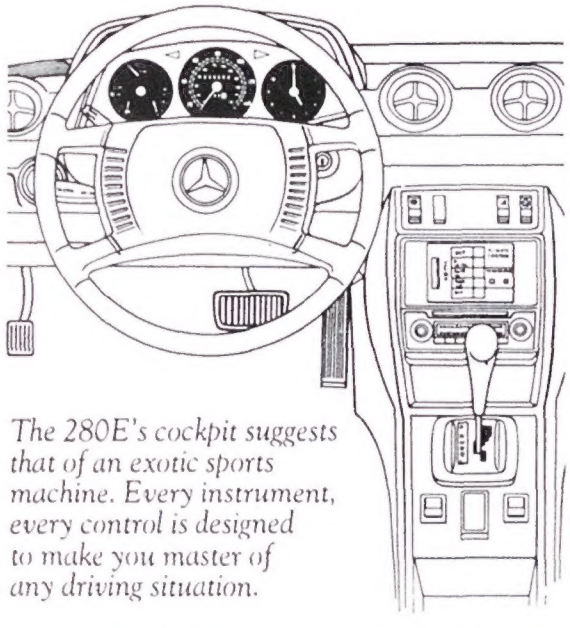
A select team of Mercedes-Benz engineers devoted six years to the conception, construction, and refinement of the 280E. More years were given to the testing of "final" prototypes. As what follows suggests, the 280E represents a worthy chapter in the Mercedes-Benz legend.

The ultimate challenge

Probably the ultimate design challenge is the appropriate proportioning of a car's size, weight, and *usable* space. In the 280E the Mercedes-Benz engineers demonstrate an exquisite sense of proportion. Inside, there is ample space for five adults. And the trunk is a full 17.7 cubic feet—*all* of it usable.

The 280E's power plant is a refined version of the sophisticated Mercedes-Benz double overhead camshaft six, and its performance has been enhanced with the simplified C.I.S. *constant flow* fuel injection system.

The improved "zero-offset" front suspension alone is, quite possibly, an engineering masterpiece, providing uncanny directional stability and braking.



The 280E's cockpit suggests that of an exotic sports machine. Every instrument, every control is designed to make you master of any driving situation.

Operating in conjunction with the Mercedes-Benz recirculating-ball power steering, it produces a quick maneuvering response and an incredibly tight 37-foot turning circle. And the 280E features a fully independent suspension system for each wheel to increase the automobile's stability and dampen road shock.

Safety x 100

A host of Mercedes-Benz engineering achievements have contributed to the unusual safety systems of the 280E.

Each wheel has its own servo-assisted disc brake. The steering column is designed to telescope three ways. Front and rear bumpers are self-regenerative. All told, over one hundred separate safety elements and systems are combined in the 280E.

See your Mercedes-Benz Dealer for a unique experience. The experience of driving the 280E—the Practical Sports Sedan.

Mercedes-Benz

Engineered like no other car in the world.

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The Kodak Ektasound movie camera makes it so easy to take sound movies. Just drop in a cartridge of film, such as Kodak Ektachrome 160 sound movie film, and push the shutter release. It's that simple.

And the microphone? It's right on the handle! So, you're free to move around and shoot wherever you want without worrying about cords or microphone placement.

You don't need movie lights, either. Indoors or outdoors, in room light or sunlight, the Kodak Ektasound movie camera takes colorful sound movies without movie lights.

There's also an automatic exposure control that adjusts the amount of light reaching the film.

Kodak's unique on-camera microphone. Sound made simple.

And, there's a sound monitor so you can hear what the camera is hearing–both before and during use.

Ask your photo dealer for a demonstration. There are several models to choose from including the new model 250 with power zoom and the new model 260 with power zoom and coupled rangefinder.

Kodak Ektasound movie cameras